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CONTENTS OF VOLUME VIII.

PLATES 1–17.

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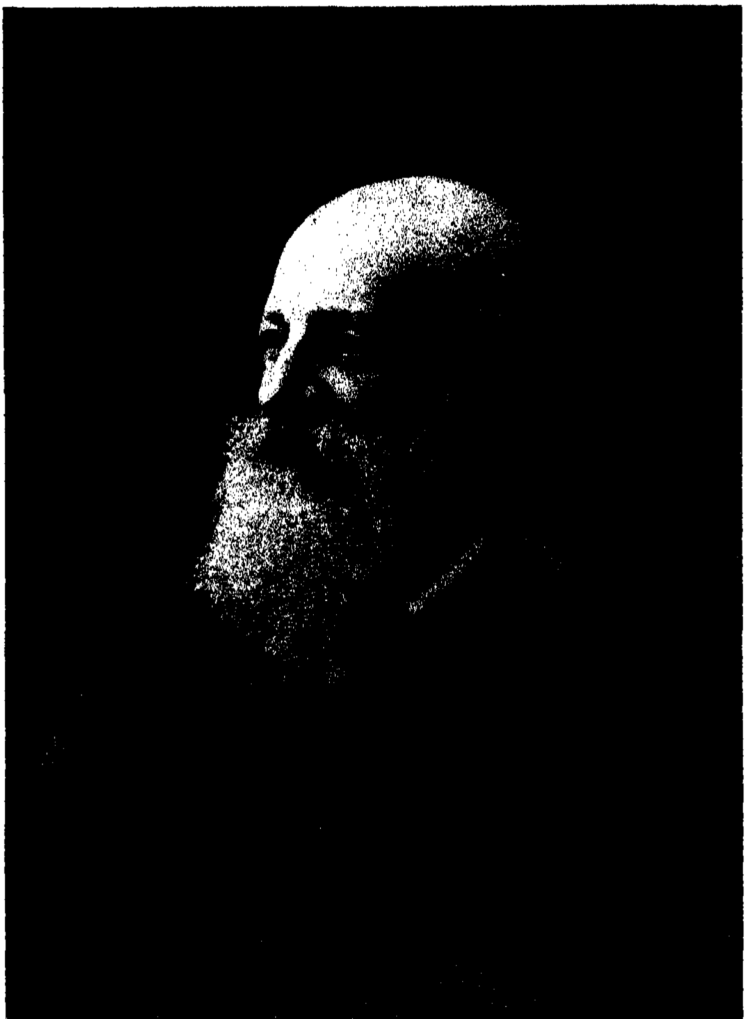

Theodore H. Hittell

PROCEEDINGS

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I

IN MEMORIAM: THEODORE HENRY HITTELL[1]

Born April 5, 1830—Died February 23, 1917

The California Academy of Sciences was bereaved of one of its most illustrious members in the death of Mr. Theodore Henry Hittell, February 23, 1917. He would have been 87 years old in two months. For nearly 30 years he had been an uncompromisingly loyal and assiduous member of the Academy, and in the future history of this institution, the value of his personal attachment and fidelity will grow ever clearer and stronger.

What a span of life was his! He was born April 5, 1830, and it is true to fact to say that the world has traveled farther since that year than during all its previous recorded history. In 1830 the echoes of the battle of Waterloo had hardly died away. Napoleon had been dead scarcely nine years. Charles X was King of France, but the Fates had decreed that within the next few months he was to give way to Louis Philippe. William IV this year succeeded George IV as King of England, and Victoria's memorable reign was to begin seven years later. The United States had but fairly started in the second half century of its experiment as a Republic. Andrew Jackson was President and the brewing of Nullification in South Carolina was raising the shadow of the coming Rebellion over States' Rights and Slavery. Railroads were in their infancy. The

[1] Read at the regular monthly meeting of the California Academy of Sciences, August 15, 1917.

first practical locomotive to run in America was delivered the previous year; and the first American locomotive was made in the year 1830.

Gauged by the tremendous sweep of Science since that period, it is fair to say that Science was then just starting on its real career. It will probably not be disputed that the age of Darwin is a sharp dividing line between ancient and modern science. Present methods of research and generalization are now so commonplace that the older limited, narrow systems seem to belong to the distant dark ages. And yet in the year 1830, Charles Darwin was an undergraduate in Cambridge University, which he had entered in prospect of being a clergyman. He was now becoming fascinated with natural science, and his history-making voyage in the "Beagle" was to begin the following year.

What was to become Hittell's beloved California, was in 1830 but an obscure province of Mexico, known as Alta California. Its northern boundary was San Francisco Bay. The Missions were already withering under the threatened blow of Secularization. There were about 30,000 Indians here, who were reduced in a few years to 10,000. The white people were few and almost wholly Spaniards. The mode of life of the Spaniards was, in description, charming. It had an ease, a hospitality, a gaiety unequalled. There was but little industry beyond the raising of cattle, which were killed in immense numbers for their hides which were sold to the occasional sailing vessels which came to the Coast. It was not until four years later that Richard H. Dana was to start on that voyage from Boston to California, which called forth *Two Years Before the Mast,* a book which W. Clark Russell has termed "the greatest sea-book that was ever written in any language." John A. Sutter did not come to California until 1839. San Francisco was not. Yerba Buena was the bay "which came up to Montgomery Street" and was very seldom visited by sailing vessels. There was a dilapidated Presidio, and several miles distant was the already waning Dolores Mission. The major portion of California was a vast desert for the greater part of the year. The Sierra Nevada Mountains were but little known, and most of the civilization was on or near the Coast. There was but one Custom House, which was situated at Monterey. The coast was bleak and repelling, though relieved in the spring

season by a few oases of green. "On the whole coast of California, there was not a light house, a beacon, or a buoy, and the charts were made up from old and disconnected surveys by British, Russian and Mexican voyagers." At that time, California, except for a short season, was substantially a vast, forbidding, unlovely waste. Its possibilities were not suspected. It awaited the magic touch of Anglo Saxon civilization.

It was on April 5, in this year of 1830, that Theodore H. Hittell was born, in Marietta, Lancaster County, Pennsylvania. As would naturally be expected of one of his strong and versatile character, his ancestors were sturdy, thrifty and solid people. His paternal great grandfather, Peter Hittel, was a Protestant, brought up in Rhenish Bavaria, and driven into exile by religious persecution. He, with a brother, escaped into Holland, thence coming to America in 1720, and settled down in Upper Milford Township, in Lehigh County, Pennsylvania, where he passed the remainder of his life as a farmer. He was successful, progressive and energetic, and was a forceful, and useful member of the community.

Peter's son, Nicholas Hittel, the grandfather of Theodore, remained on the farm in Upper Milford Township. He was a man of prodigious physical strength, and was an industrious and successful farmer, and, it is said, came to be regarded by his neighbors as a sage. He married Susanna de Vesqueau, or Wesco, as the family name was later called. Her father, Francis de Vesqueau, was a French Huguenot, and was driven by religious persecution from his home in Alsace, and came by way of Holland to Pennsylvania. He and his two sons served in the American Revolution, Francis being in the Second Battalion, Second Company of Northampton County, Pennsylvania. Nicholas Hittel also served in the American Revolution in the Northampton County Militia, from 1778 to 1782. The family of Nicholas and Susanna consisted of eleven children.

Jacob Hittel was the eighth son and the last child of Nicholas. He was the father of Theodore and was as remarkable a man as his son. He was brought up as a farmer's boy, and at fifteen years of age, he could speak only in Pennsylvania German. He hungered for an education and began attendance at an English school. This was three miles and a half from his home, and he walked to school and back every day, whatever

the weather or the condition of the roads. When sixteen years old, he walked to Philadelphia, a distance of forty-seven and a half miles, to go to a better school. He found a good family where he worked each half day for his board, and went to school the other half day. He bought an English dictionary, which he studied incessantly. In carrying out his steadfast purpose, he would work and save until he had accumulated a small sum of money; then he would devote himself to school until the money was exhausted. Thus, by intense industry and unremitting frugality, he acquired a good English education. When he was twenty years old, he decided to become a physician, and began studying in the office of Drs. Benjamin and James Green, at Quakerstown, Pennsylvania. The next year, he entered the College of Physicians and Surgeons at Philadelphia, but at the end of two years his funds were exhausted. In those days, it was the custom of medical students, if they so desired and felt competent, to enter upon practice before final graduation; and therefore, in his twenty-third year, the young doctor opened an office at Segersville, Lehigh County. This same year he married Catherine Shertzer, of Millerstown. Her ancestors came from Germany, and settled in Pennsylvania, and were successful and influential people. Catherine Shertzer became the mother of Theodore Hittell. She lived to be over ninety years old. She was an unusual woman, of great personal charm and intellectual gifts, and her son always spoke of her with a keenness of appreciation that denoted the greatest of affection.

The newly married couple settled down in Segersville, where, due to his energy and ability, supplemented by the popularity of his accomplished wife, Jacob Hittell gained at once a large practice; so that in less than a year, he had accumulated enough money for his final year in the Philadelphia college. Thus, when about twenty-four years old, he received his medical diploma from what was then perhaps the most prominent institution of its kind in the United States.

After practicing in several small towns in that region, he removed, in 1825, to Marietta, in Lancaster County. Remaining there five years, he was attracted by the prospects of success in Ohio, Indiana and Illinois. These states were then becoming a magnet, like California in later times. The fertility of soil, beauty of scenery and cheapness of public lands were drawing

many pioneers to this "new West." Therefore, in 1831, Dr. Jacob Hittell started for Illinois with his wife and three children; but because of the health of his youngest child, Theodore, he changed the destination, and settled in the famous Miami Valley, at Trenton, Ohio. From the beginning he was successful and his increasing practice induced him to remove to the more important town of Hamilton, about ten miles distant, and a few miles north of Cincinnati. This became the permanent family home, and so remained for thirty-four years. Here Dr. Jacob Hittell's professional skill, activity in business investments and energy in public matters made him a very prominent and influential citizen. Realizing his own tremendous difficulties in obtaining an education, he took a special interest in the public school and the Female Academy at Hamilton, and assisted and encouraged his children in obtaining a good education.

Thus, though born in Pennsylvania, Theodore Hittell's conscious life began in Hamilton, Ohio, he being only a year old at the time of the family removal. At the earliest possible age he was sent to school, because it was an understood rule in the family that each child was to be given the best education attainable in the country, and should be obliged, unless prevented by sickness, to keep on steadily at work in acquiring it. The boy was "father of the man," and his studies were characterized by great industry and thoroughness. All his life, he made it a rule to carry out to a finish what he had once begun, and to do everything in the very best manner it was possible for him to do it. Concentration on the work in hand and carrying it to completeness were among the most marked secrets of his success in life. He early became a "prize pupil" in algebra, geometry and trigonometry. He was handy with tools and very ingenious; he also worked in his father's drug store, where he learned considerable about the technical parts of the business. At about fifteen years of age he was sent to a Catholic school, then to a select school to study Latin and Greek. Meantime he had read many books, and all of them he "chewed and digested." His boyhood was pleasant and happy, and very busy. Though absorbed in his work, none turned to amusement and recreation with more zest than he.

In 1845, at the age of fifteen years, he entered Oxford College, afterwards known as Miami University. Here he had the usual studies of Latin and Greek, and mathematics. Characteristically he applied himself devotedly to his books, and became especially proficient in mathematics. He joined a literary society, but as he had no idea of ever becoming a public speaker, his activity was confined to written addresses on literary subjects. He read indefatigably, especially history and biography. He left the college because of the students' "snowball rebellion" against the faculty, which rebellion virtually caused the temporary ruin of the institution.

From there he went to Center College, at Danville, Kentucky, where he stayed during his junior year. He was not satisfied with the educational advantages of the institution and determined to go to Yale College, where he achieved the unusual distinction of gaining admittance to the senior class of Yale from the junior class of a small western college; due largely to his proficiency in mathematics and originality in working out theorems and problems. In 1849 he graduated from Yale College with the degree of Bachelor of Arts.

He was now nineteen years of age. In the following year he began reading law in the office of Charles Fox, at Cincinnati, and was admitted to the Ohio bar in 1852.

He had now earned and won a good education and admission to the profession of the law. He was in his twenty-third year, in perfect health, with an upright and incorruptible character, a widely varied and valuable experience, and a trained and industrious mind. For several years he practiced law at Hamilton, Ohio, but the life became irksome to him. His father, and all of his ancestors, were pioneers, and the call of his inheritance was strong in his veins. His brother John had come to California in 1849, and Theodore could not longer resist the lure of the Golden West. On October 5, 1855, he came from New York to San Francisco by way of the Isthmus of Panama. Thus, in her early history, did California feverishly dig her gold, which was her supposed only treasure, and send it to the East, to be rewarded by the return of far more priceless treasures—resolute, virile citizens.

Upon reaching San Francisco, Mr. Hittell plunged into the life of one of the strangest, busiest and most romantic cities

on the face of the earth. Twenty years before, Yerba Buena was not even a village, and had no existence. Nine years before, Yerba Buena had started on its career and had two hundred people. Eight years previously, the name was changed to San Francisco. The discovery of gold created a city almost overnight, and San Francisco now had a population of 50,000. Five great fires had successively destroyed it, but the buildings were now more numerous and enduring than ever. In such a seething mass of gold seekers, adventurers and real pioneers there were inevitably mingled much lawlessness and crime. At least a hundred murders had been committed in the previous year without a single execution. It was not safe to walk the streets after dark, while by day and night incendiarism and burglary were common. Allied with this individual crime was political corruption. Though the city had been partially purged by the Vigilance Committee of 1851, the baser elements were again in control. As usual in modern times, the good men did not vote and the bad men never failed to vote. In his *History of California* Hittell phrased the situation thus: "There probably had never been in the United States a deeper depth of political degredation reached than in San Francisco in 1854 and 1855." In spite of bad government and prevalent crime, nothing was able to prevent the town from forging ahead. The golden stream from the mines, the dawning realization of the immensely varied agricultural resources of the State, the first fruits of foreign commerce, revealed to the sagacious eyes of the pioneers the splendid destiny of this city and State. These good citizens could not yet control the development of the civic and material resources; but they were dazzled by the vision of the future, and hopefully consecrated their souls and energies to the building up of the new community.

When he started for California from the East, Mr. Hittell intended to go to the mines. As soon as he reached San Francisco, and saw its activities and gauged its prospects, he was easily convinced by his advisers that this city should be the theatre of his future career. Though a thoroughly educated lawyer, he seems at first to have avoided the practice of his profession, and with his literary tastes and training he naturally gravitated towards the newspaper business. The

financial failures of the year before, and the speculative transactions of each busy and exciting day, resulted in an immense amount of litigation. News from the outside world was scant, and except for world events of sensational magnitude the people depended for their news on local happenings and the developments of the courts. In consequence, the local editors of the newspapers were of unique importance, and the court news was greatly sought after by the public. Mr. Hittell began by reporting law news for a German paper published in San Francisco. His previous training now became of great value. The accuracy of his reports, the inclusion of all of the essential points of a judge's decision, the fidelity to facts, soon attracted the attention of the editor of the "Bulletin." This paper was founded by James King of William in the latter part of 1855, and by its fearlessness in attacking criminals and dishonest men in public life, and by its decency and vigor, in a short time reached the distinction of being the leading newspaper in the city. Mr. Hittell soon became the law reporter for the Bulletin and was such at the time of the assassination of James King of William and the revival of the famous Vigilance Committee in 1856. Though not personally a member of the Vigilance Committee, he was their staunch supporter, their reliable chronicler. He logically became the local editor of the Bulletin, which was a position of great responsibility and importance during these stirring times. He prided himself upon the accuracy of his columns, and no news was printed that was not true and trustworthy.

He retained his connection with the Bulletin until 1860. The rising tide of disunion had brought California actively into the national contest. In the State were many of Southern birth or with Southern sympathies, of great energy, resources and influence. Mighty and successful efforts were made to keep California in the Union. These were the historic days of Baker, Broderick and Starr King. For a year previous and during the first part of Lincoln's campaign, Mr. Hittell was the local editor of the San Francisco Times. He was very patriotic in sentiment, an ardent Union man, and gave valiant service for the cause of human liberty.

During this period, on June 12, 1858, he married Miss Elise Christine Wiehe. She was the daughter of Dr. Carl

Wiehe, of Goedens, in the northeast corner of Germany. Dr. Wiehe was chief surgeon on the staff of Field Marshal Blücher, and was present at the battle of Waterloo. The daughter left Germany on account of the events of 1848, and came to California on a sailing vessel by way of Cape Horn. It is said that she trimmed and introduced the first Christmas tree in San Francisco. After her marriage, she took much interest in Science, and with Mrs. Brandegee and Miss Rita Haggan was among the first women members of the California Academy of Sciences. She was one of the founders of the San Francisco Foundling Asylum. She also founded the Silk Culture Society of California. She actively urged the establishment of manual training schools. She was one of the pioneers in advocating the organizing of a museum in San Francisco. She was interested in the preservation of the Indian picture writings found in California, and wrote an article on the subject for "Science" magazine. Her last published article was on Pasteur, in "Science." She died in 1900.

Mr. and Mrs. Hittell had four children, of whom three are now living: Catherine Hermanna, Charles Jacob and Franklin Theodore. They were all born at the old home at 726 Folsom street, in this city.

It was in a great measure due to the solicitations of his wife that Mr. Hittell decided to re-enter the practice of the law. In 1861 he joined the San Francisco bar, and in 1862 he formed a partnership with Elisha Cook that lasted for five years. He devoted himself to civil law, and only once in his legal career tried a criminal case. Upon one occasion he was asked by John B. Felton to prepare a brief, and the document was so clear and cogent that Mr. Felton immediately offered him a partnership, which was promptly accepted. This partnership lasted until Mr. Felton's death in 1877.

John B. Felton was one of the ablest lawyers in the history of the State. He was a type of that period, one might say almost a product of his day and of San Francisco in the sixties. He collected vast amounts in fees, but spent his income with princely lavishness. He had astonishing ingenuity in applying the principles of law, and great quickness and exactness of observation. His brilliancy at the bar, prodigality of

living, versatility as a public speaker, remarkable wit and excessive generosity are among the traditions of this city and State. But with all this he was not a man of extraordinary industry in detail; therefore to be associated with a man of the dogged diligence and legal resource and exactness of Mr. Hittell was the opportunity of a lifetime. In turn, to have such a legal associate as Mr. Felton was the opportunity of a lifetime for Mr. Hittell. Each supplemented and was invaluable to the other. Mr. Hittell wrote the briefs and mainly conducted the office business. He was a model of careful industry, and of powerful and logical statement. While he personally was not largely in the public eye during this period, he gained a reputation as a lawyer of great reliability and singular skill.

Mr. Hittell was associated with a number of cases famous in the legal history of California. Conspicuous among these were the Lick Trust case, the Montgomery avenue case, the Dupont street case, the case involving the title to the lands near the ocean beach of San Francisco, and the famous San Pablo land case. In the ocean beach case he settled the title to the lands out among the sand dunes, and by a compromise between the claimants and the city of San Francisco, secured a deed for one thousand acres of land to the city which is now comprised in Golden Gate Park. The great San Pablo land case was technically known as Emeric against Alvarado. It began in 1868, and after twenty-seven years of dogged, persistent fighting, he won his case in 1895. The land titles involved were in Contra Costa county, especially in and about Richmond, and this noted case forever settled the earlier titles to every piece of property in the city of Richmond. This case gave him a position as a distinguished authority in the inextricably complicated question of land titles in California. Due to the earlier ambiguous Spanish land grants, followed by the equally ambiguous Mexican land grants in California, the titles were universally tangled, almost beyond settlement; and Mr. Hittell's work went greatly beyond the adjustment of his particular litigation. The winning of this suit brought him much legal fame, for it alone was enough to establish his position as an eminent lawyer. His other noted lawsuits evidenced the same shrewdness and ingenuity and unflagging pertinacity.

When the Constitution of California was adopted in 1879, Mr. Hittell became greatly interested in State politics. He was elected as State Senator from San Francisco and served during 1880-82. The legislature was flooded by bills of all kinds evoked by the spirit of the sand-lot agitation, and by the new Constitution. Because of his sane and balanced character, aided by his wide legal attainments, he was a moving force in the Senate, and performed notable and valuable service for his State. Many an ill-considered or iniquitous piece of legislation went into oblivion through his shrewd and sagacious opposition. He re-drafted the entire Code of Civil Procedure to conform to the new Constitution, and his work was adopted in preference to that presented by the regularly appointed commissioners. He was always a tremendous worker, and a high authority says of him that "the greater part of the statutes of 1880 was his work."

After the close of his Senatorial career, he again devoted himself to the practice of law. Even as late as 1906, he acted as attorney for his old clients.

His legal practice brought him much honor and a large fortune. The last twenty years of his life were devoted mainly to his writing. The astonishing vigor of his mind and body lasted to the end. By systematic temperance in living he possessed perfect health through his whole life. His principal exercise was walking. He often came down town from his home on Turk street above Van Ness avenue, but rarely took a street car. As late as his eighty-seventh year he occasionally walked from his home to the Cliff House, a distance of six and a half miles. He had no final illness. Five days before his death, he took to his bed because of physical weakness; and the evening before his death, with a mind as clear as ever, he told his physician that he was feeling well. He passed away peacefully and without pain,

> "Like one who wraps the drapery of his couch
> About him, and lies down to pleasant dreams."

Though the practice of law was his chosen profession, the writing of books was his chief love. From the amount produced, one might think that he lived always with a pen in his hand. Of law books alone, he was a voluminous author, and

his written contributions to law literature were substantial and of high value. As a matter of record, his law books are given herewith:

The Civil Practice Act of the State of California was published in 1863; later edition, 1868.

In 1865, *The General Laws of California,* two volumes; a fourth edition, two volumes in one, in 1872. This work had a particularly wide reputation, one authority saying that "it was the most comprehensive and valuable law book ever published in California."

In 1876, *The Codes and Statutes of the State of California,* two volumes in one. A supplement, in one volume, was published in 1880.

He was also the author of *Reports of Cases Determined in the Supreme Court of the State of Nevada,* six volumes, 1868-74.

At this late date, and to the lay mind, the enumeration of the dry titles of old law books furnishes small indication of his real achievement. Such works require minute exactness, conciseness, clearness and a highly trained intellect. These qualities Mr. Hittell brought to bear in his legal writing. His books became indispensable parts of every attorney's office. He was regarded as a trustworthy authority in certain branches of civil law, and he was frequently quoted in our courts and even in the Supreme Court of the United States.

Though a prolific author of law books, Mr. Hittell's dearest occupation was writing books of general literature, but principally of history. His legal activities accounted for a life filled with strenuous labor; but his tireless pen was incessantly busy, and brought forth fruits in other fields, sufficient for the career of most hard working men.

His first published book was *The Adventures of James Capen Adams,* printed in 1860. While local editor of the Bulletin, he was one day attracted by an animal show which was holding in a basement on Clay, near Liedesdorff street. Among the live animals were three grizzly bears, named Samson, Ben Franklin and Lady Washington. Samson was of enormous size and was said to weigh fifteen hundred pounds. He was captured when grown, and, though not wild, was untamed, and kept in a cage. The other two grizzlies were

captured when cubs and had been tamed by the owner. Mr. Hittell noticed that the fur was worn off the backs of the tame bears and was amazed to learn that they had been used in the mountains as pack animals and that the owner rode them when necessary. It did not take Mr. Hittell long to become very well acquainted with the owner, whose name was James Capen Adams, a hunter who had spent years in the Sierra Nevada mountains. Adams had passed through such curious and fascinating experiences that Mr. Hittell determined to write a book about such an unusual bear hunter. In consequence, for a year and a half, by tacit arrangement, the author visited the animal show each afternoon after the newspaper went to press, and listened to the hunter's tale. These conversations he embodied in one of the best bear books ever written. It was published in San Francisco and also in Boston in 1860, but due to the Civil War it was not widely distributed. The book contained 370 pages, was illustrated by a number of wood cuts by Charles Nahl and had a brown cloth cover.

And now comes an odd and interesting sequel. Half a century later, in 1909, Charles Scribner's Sons published a notable book called *The Grizzly Bear,* by William H. Wright. Its author was born in New Hampshire. In his preface he makes the following remarkable statement:

> "I have often seen in the newspapers and magazines replies of various persons of note to the question, 'What book has exerted the greatest influence on your life?' Most of these answers I notice are rather hazy, but if I had ever been asked to reply to this question, I should have been able to answer without any hesitation. And my answer would have been, 'The Adventures of James Capen Adams, Grizzly Bear Hunter of California.'"

As a result of Wright's book, Scribner's got into communication with Mr. Hittell, and in 1911, they issued a second edition of the James Capen Adams book, exactly in the original form, as to type, illustrations and old brown cloth cover, with an introduction and postscript added by the author.

In 1872 he published a criticism of Goethe's *Faust.* It contained forty-six pages and was bound in paper covers. It was

a serious attempt to interpret the great poem which has been a puzzle to leading critics for over a century. The review displayed much acumen. It was written with more than ordinary care, and furnishes a fascinating introduction to the study of one of the greatest of literary works.

Stephen J. Field, after an eminently successful legal career in California, became Justice of the Supreme Court of the United States. Around his picturesque experiences clustered many of the exciting episodes in the history of the State. The Sharon will case, involving Sarah Althea Hill and former Chief Justice Terry, culminated in the shooting of Judge Terry by U. S. Marshal Neagle, at Lathrop, Cal., while Neagle was acting as guard over Judge Field under instructions from the United States Department of Justice. This tragic event caused a great sensation throughout the United States, while California was for the time in a turmoil of discussion over the event and the causes that led up to it. Judge Field was constantly importuned by his friends to write the story of his dramatic life, and at length he dictated his reminiscences to Mr. Hittell. This was in 1877. Judge Field decided to issue the book privately, for distribution to his friends only. In 1893 a second edition was printed for private distribution, but the book was never officially published. It is not generally known that Mr. Hittell wrote these reminiscences, although it could easily be inferred by a careful reader; because on page 108, edition 1893, occurs the following sentence: "Here my narrative of 'Personal Experiences' must for the present end. I could have given you, Mr. Hittell, more interesting matter." The volume is entitled *Personal Reminiscences in California,* and besides the dictated portions and an article from the Sacramento Union on the career of Judge Field, includes an elaborate statement of the Sharon litigation and the sensational events that focused in the death of Judge Terry, written by George C. Gorham, a personal friend of Judge Field, and for many years Secretary of the United States Senate. It is a book of absorbing interest and is now very rare.

It was during his law partnership with Mr. Felton, and in the most exacting period of his legal career, in 1871, that Mr. Hittell began the stupendous work of writing his *History*

of California. His experiences of six years as a San Francisco editor and his delving into historical records in connection with his law work, had revealed to him the wealth of material for an amazing story. It was practically a virgin field. Though up to that time there had been a number of books on certain picturesque phases of San Francisco and California, there had not yet appeared an orderly, continuous and comprehensive record of the great drama of the discovery, settlement and development of this State. His literary imagination leaped at the visioned opportunity.

The principal material for the early history of the State was buried in that immense and practically undigested mass of documents known as the "Archives of California." These were in manuscript, mostly in Spanish, a very few in English, German and Russian. Soon after California was admitted as a State, the vital value of these early documents was seen, both in reference to the complex land titles and also as historical records. They consisted of letters, proclamations, Mexican and Spanish official orders and various memoranda. At length, by order of the United States Government, they were collected and bound. Though there was an attempt to segregate them into convenient classifications, it was a difficult if not an impossible task. In consequence, documents germane to a given subject would be found in widely scattered volumes, which made the gathering of material much more complicated and vexatious.

These "Archives of California" comprised nearly three hundred bound volumes of about 800 pages each and contained about 250,000 written pages. They were in the office of the U. S. Surveyor General in the U. S. Treasury Building, on Commercial street. In the great fire of 1906 the larger portion was burned, but many of the documents can possibly be restored due to the Spanish system of preservation. Some certified copies are now in Mexico or Spain, and some may be found in the British Museum and various libraries in this country.

For historical purposes the Archives were absolutely indispensable, and in them Mr. Hittell found a great part of the material for the early period. As a rule, the chirography was good, though in many instances the ink had faded. Since

coming to California, Mr. Hittell had learned more or less Spanish and he now cultivated a further acquaintance with the language until he could read it with considerable ease. For several years he almost daily visited the office of the Surveyor General, and carefully copied the necessary original documents. At his home now are thousands of pages of these copies, which should prove to be of much value to the future student of history.

After fourteen years of gigantic toil, in 1885 he published the first two volumes; and twelve years later, in 1897, the last two volumes. At that period there were few stenographers—scarcely any outside of the courts—and no typewriting machines. Every word was written by himself in long hand. He had no clerk, assistant or amanuensis. His voluminous notes were in Spanish, German and French, as well as English.

The work was hailed with high acclamations by all classes. It is a monument to the author's painstaking genius, and considering the period in which it was written, it is a master work. It abounds in noble passages of ofttimes eloquent English. It is detailed, and yet in proper perspective. The early portion was drawn directly from original, official but unpublished sources. The later portion was even more valuable and interesting, for the author was a keen, trained observer of the events written about, and often a participator in them. And yet his determination to be impartial was so strong that the reader would have difficulty in believing that the author was an eye-witness and often an actor in the scenes described. Inevitably, where current happenings are told, people have diverging opinions. Many persons may have differed from his conclusions, but there were few to deny that the work was a dignified, accurate account of the State from its earliest beginnings, and a weighty and valuable contribution to history. It is a veritable mine of fact and reference. Since then, and especially of late years, has arisen the school of scientific historians, and much attention is at present being given to a minute study of California history, especially from the archives in Spain and Mexico; and therefore the writing of Pacific Coast history is now on a firm and satisfactory basis. When Mr. Hittell wrote, the knowledge

of California was fragmentary and untrustworthy. He docketed the facts, set them forth in an intelligible and vastly interesting manner, and, upon a large canvas, is indubitably the pioneer of the true historians of his beloved State.

At the time of the San Francisco fire in 1906 the plates of the history were in Oakland and thus escaped destruction. Shortly afterwards they were removed to Mountain View, near Palo Alto, where they met their fate in a fire. The books are fast becoming rare.

As a historian and as a contemporary, Mr. Hittell was always an admirer of George Bancroft, whose History of the United States was for years the leading authority, and who as Secretary of the Navy under President Polk, had an active if not a predominant official part in the acquisition of California by the United States. It was a labor of love and gratitude to write a memorial address of *George Bancroft and His Services to California,* which was delivered May 12, 1891, before the California Historical Society.

In 1898 was published Book I of a *Brief History of California* by Mr. Hittell, with an introduction by Professor Richard D. Faulkner, principal of the Franklin Grammar School of San Francisco. It contained sixty-eight printed pages and was devoted to the Discovery and Early Voyages. From Professor Faulkner's introduction, the plan was evidently to publish a complete history of the State, as a school text book, in twelve small volumes, which later would be published in a single volume. For reasons not known, the plan was not prosecuted further than the first volume. The style of this little book is charming as well as simple and instructive, and it is a matter of regret that the series was not continued to completion.

Mr. Hittell wrote a comprehensive, detailed history of the Academy, styled a *Historic Account of the California Academy of Sciences,* 1853—1903. As the dates indicate, the intention was to close with the proceedings of the semi-centennial meeting of May 18, 1903. It was written up to that time, and was in the hands of the Academy authorities for publication, and about a fourth part of it was in type at the time of the great fire, April 18, 19 and 20, 1906. The printed pages, the type of which had been set up, and some twenty

pages of the manuscript, were consumed. The remainder of the manuscript was in the Academy building on Market street and was fortunately saved and removed to a place of safety. With this partial manuscript and the proofs already in hand, the complete history was restored. The beginning of the reconstruction of the Academy, immediately following the fire, made it apparent that the closing period of the epoch was not at the semi-centennial year of 1903, but more appropriately rather the year 1906. The author, therefore, brought it down to the end of 1906. Since that time it has not been possible to print the history, and it is now awaiting a time when the money shall be available for its publication. The manuscript contains 374 pages. Much of it is in Mr. Hittell's best style. His unusual skill in assembling and digesting details, his laborious patience in studying the original sources, his experience as a historian on a larger scale, gave him especial qualifications for the task. Some of the records of the Academy were destroyed in the great fire; others were to be found in different documents and written books; here all are combined in a fascinating story accurately and methodically set forth. Here will be found the amazingly romantic tale of James Lick's wonderful benefactions. Because of Mr. Hittell's personal acquaintance with the men who made the Academy's history, he could write with authority. No one else can, or ever will, tell the story so well and so reliably. The Academy, as a historic institution, deserves that such an authentic record should be published; and it is to be hoped that the near future will bring out this history in printed form.

In his miscellaneous reading, Mr. Hittell became interested in Hawaii, and it was not long before his indefatigable pen began a *History of the Hawaiian Islands.* He had never been in those enchanted isles, and at his age he shrank from undertaking an ocean voyage. But he collected practically all the literature extant upon the subject, and, beginning in about 1905, he labored upon this work for seven years. The result is embodied in 1563 pages of closely written manuscript, with a Table of Contents of 172 pages. The work has not been published. It is the most comprehensive history of these islands which has yet been written.

He next wrote a history of the Miami Valley, in Ohio. This was the home of his boyhood, and the pioneer period there and the thrilling tales of the Indians had always held a great fascination for him. The manuscript is closely written, and comprises 112 pages. The copy, or second draft, was finished January 18, 1915.

At the time Mr. Hittell arrived in San Francisco in 1855, and for the next five years, much space was occupied in the California newspapers by accounts of the sensational doings of William Walker, the filibuster. This city was the home of Walker and the starting place of his expeditions to Nicaragua. In his History of California, the author gave many pages to Walker, and in his late life he wrote a *Historical Account of Walker the Filibuster*. It was finished in 1915. As it has not been published, it is in manuscript form only, and comprises 284 pages, besides 33 pages of Table of Contents, and 19 pages of Index. It is an accurate but vivid account of one of the most noted and eventful adventurers since the days of Captain Kidd.

When he was 85 years old, Mr. Hittell began writing his autobiography. He persevered at this task to the end of his life. As was natural for one of his great age, his recollections dwelt with especial fondness upon the days of his youth and young manhood. *The Reminiscences* were written for his immediate family, and therefore he took especial pains to revive the memory of his ancestors in America, both on his father's and his mother's side. The verification of dates and the confirmation of family traditions consumed much time; and in consequence the work proceeded slowly. According to his universal custom, he wrote everything himself in long hand; his first draft was carefully copied, corrected and indexed; so that his entire manuscript was written twice. His methodical manner of working enabled him to cover much ground, so that by the end of 1916 he had produced in corrected form 270 legal cap pages of writing. Considerably more had been written as a first draft. His last entry was dated nineteen days before his death. Nevertheless, he had progressed no further than the end of his college education. It is an irreplaceable loss that he did not write of his life in California, where his real career was lived. He saw so much

that was dramatic, he was a part of so much history, that he could have produced a picture of incomparable value and interest. As far as it was written, the Reminiscences contain many delightful passages, particularly those descriptive of the home life in Ohio, three-quarters of a century ago, a period now forever past.

In addition to papers delivered before the Academy of Sciences, which will be mentioned later, Mr. Hittell published or delivered the following, which are given here as a matter of record:

Theodore D. Judah. The Engineer of the Central Pacific Railroad. 30 pp. Delivered at Stanford University, February 21, 1896.

The Discovery of Humboldt Bay. 40 pp. Read before the Society of California Pioneers, April 9, 1889.

How Yosemite Was Discovered. 33 pp. Read before the Society of California Pioneers, January 8, 1890.

The Place in History of the California Pioneers. 8 typewritten pp.

The Big Bonanza. Published in "Land of Sunshine," September and October, 1899.

Geographical Peculiarities of California. Published in "Land of Sunshine."

Observations on the New Constitution. Published in "Overland Monthly," January, 1883.

On the Tip Top of the United States. Published in "Sunset Magazine," February, 1903. This was a description of his climbing to the summit of Mount Whitney, June 23, 1902, when he was over seventy-two years old.

Considering the career and the character of James Lick, his benefactions were an unparalleled deed of philanthropy. With the disposition of Lick's property, Mr. Hittell was closely associated. His partner, Mr. Felton, and himself, were Lick's attorneys through the long period of legal complications, and Mr. Hittell became not only Lick's reliable legal counsel but his trusted personal adviser. When Lick was preparing his Trust Deed which disposed of all of his vast property, Mr. Hittell suggested that he make the California Academy of Sciences and the Society of California Pioneers his residuary legatees. Mr. Lick thought the proceeding un-

necessary, remarking that he was now giving away all of his property, and there was nothing left. Mr. Hittell observed that it usually required considerable time to settle up an estate, and that there might be something left over after all the specific gifts were paid. James Lick followed this advice, and his Trust Deed, after naming the specific gifts, divided the residue into equal proportion between the California Academy of Sciences and the Society of California Pioneers. On September 28, 1875, the Academy accepted the Lick deed, and October 2, 1876, the death of James Lick was announced. As predicted, when the estate was settled, there was a residue, which, owing to the tremendous rise in the value of real estate and the careful management of the trustees, amounted to over $1,100,000, of which half was received by the Academy. This institution is thus indebted to Mr. Hittell for his influence and his suggestion for a vast fortune, which made possible many years of active and efficient service in the cause of Science.

In September, 1906, a special committee was appointed by the Council of the Academy to represent the Academy at the anniversary exercises of the California School of Mechanical Arts, to take steps for the future proper observance of September 21st as the day on which James Lick executed his donation. At a meeting held October 1, 1906, Mr. Hittell, representing the committee, presented and read a report. It included such an eloquent recognition of Mr. Lick's philanthropy that it seems appropriate here to quote the following paragraph:

> "The more his [Mr. Lick's] bequests are studied and the greater the insight gained of the objects and purposes contemplated by him, the more is the mind impressed with the real greatness of the man. Of all the many cases in which men have devoted great wealth to public purposes, there was not one, considering all the circumstances, that could compare in the genuine spirit of benevolence and beneficence and the wisdom of its distribution with that of this grand old Californian. In this last act of his long and laborious life, in which he gave the results of his life's toil, and, as it were, his life

itself for the benefit of his fellow man, he seemed to have risen above the frailties of human nature and stood forth as a model for respect and admiration."

The Academy of Sciences is indebted to Mr. Hittell for another important benefit, which grew out of a voluntary service he was faithfully performing. It has been noted that at the time of the great fire of 1906 his History of the Academy had been completed to the year 1903. Although the greater part of the books of record of the Academy were saved on that historical morning, those of the Board of Trustees were destroyed. These contained, among other things, the accounts of expenditure for the construction of the building on Market street. The only available if not the sole evidence of these accounts was the copies which had been taken for the object of writing the Academy history; and they were used for this purpose in the negotiations and settlements with the insurance companies, thus proving of great value.

It was on September 5, 1887, that Mr. Hittell became a member of the California Academy of Sciences. On January 5, 1903, he became a life member. He identified himself with its interests and seldom missed either a regular or special meeting when it was in his power to attend. In addition to the regularity of his attendance, he wrote and presented the following papers:

Sutro's New Water Power. 4 pp. Read October 15, 1888.

Memorial on the Death of Professor John LeConte. 4 pp. Read June 1, 1891.

The Acorn and the Oak. 19 pp. Read February 4, 1889.

Change of Level in the San Francisco Peninsula. 5 pp. Read December 16, 1888.

Oysters in San Francisco Bay. 15 pp. Read November 6, 1893.

Remarks on the Alameda Shell-Mound and Indian Medicine Tube. 14 pp. Read October 15, 1894.

The Last of the Yosemites. 34 pp. Read April 9, 1890.

Pioneers in Death Valley. 25 pp. Read November 3, 1902.

Historic Sketch of the California Academy of Sciences. Read at the Semi-Centennial Anniversary, May 18, 1903.

Dr. George Chismore. 11 typewritten pages. Dated March 5, 1906.

Memorial in Remembrance of General Lucius Harwood Foote. 6 typewritten pages. Dated July 7, 1913.

He also wrote memorials on Dr. H. W. Harkness and Mr. William Alvord, which were printed by the Academy.

He was elected a member of the board of trustees of the Academy on January 4, 1909, and served until his resignation on January 18, 1915. Thus, from the time he was nearly seventy-nine years of age until he was nearly eighty-five, he was active as a trustee, and the records will show that in that entire period of service he attended every meeting of the board but one, or possibly two.

In the Academy campaign of 1904 for the State Constitutional Amendment exempting the Academy from taxation, he took an active part. To every newspaper in California that opposed the amendment he wrote letters of argument and explanation, and indubitably his cogent statements had a sensible effect upon the attitude of the press.

When the time came for pressing the plan to move the Academy of Sciences to Golden Gate Park, it was Mr. Hittell who drew up the amendment to the city charter, which was unanimously accepted *in toto* by the Board of Supervisors, and passed by a very large majority of the vote of the people in 1910.

And thus, in all ways, he gave evidence of his acute, personal interest in the Academy. He was as loyal to this institution as a true patriot is to the country of his allegiance.

Besides being a life member of the Academy, he was an honorary member of the Society of California Pioneers. He belonged to no other organizations.

Theodore Hittell was a man of much versatility of talent. Among the principal assets to which he owed his various achievements were perfect health and the ability for long-sustained, arduous work. He was rarely if ever ill during his long life. He carried on for extended periods the equivalent of the work of two men, as this record of his life has demonstrated. Though it is probable that the definition of genius as being a capacity for taking infinite pains will not explain the astounding manifestations of real genius, it is

unquestionably true that this ability can lift talent above its normal level and make it super-efficient in its results. Mr. Hittell possessed great patience, and an immense capacity for taking pains. Possibly these were the dominant notes in his character.

It was this genius for details that made him a painter of considerable skill. His early love of drawing was born at his mother's knee. Later he attracted a good deal of local attention for his pen and ink drawings. He soon flowered into oil painting, which became one of the principal amusements of his early life. In those days painting in oil was complicated by the necessity of grinding his own colors; but he became almost infatuated with oil painting, and some of his productions are still in existence. At Yale College he gained a reputation as a cartoonist and his sketches were well known and very popular.

Like most writers, he also wrote poetry. In his earlier life he translated a number of poems from the German. In the issue of September, 1903, Sunset Magazine published his poem entitled *A Blackfoot Burial.* The same magazine, in June-July, 1906, printed his *Phoenix Redivivus,* written to celebrate the arising of San Francisco after the fire and earthquake of that year. In April, 1907, the same magazine printed his poem, *Reconstruction,* devoted to the same subject.

He was familiar with a number of modern languages, and could read with ease German, Spanish, French, and also to some extent Italian and Portuguese. He never attempted to speak in any foreign language but German.

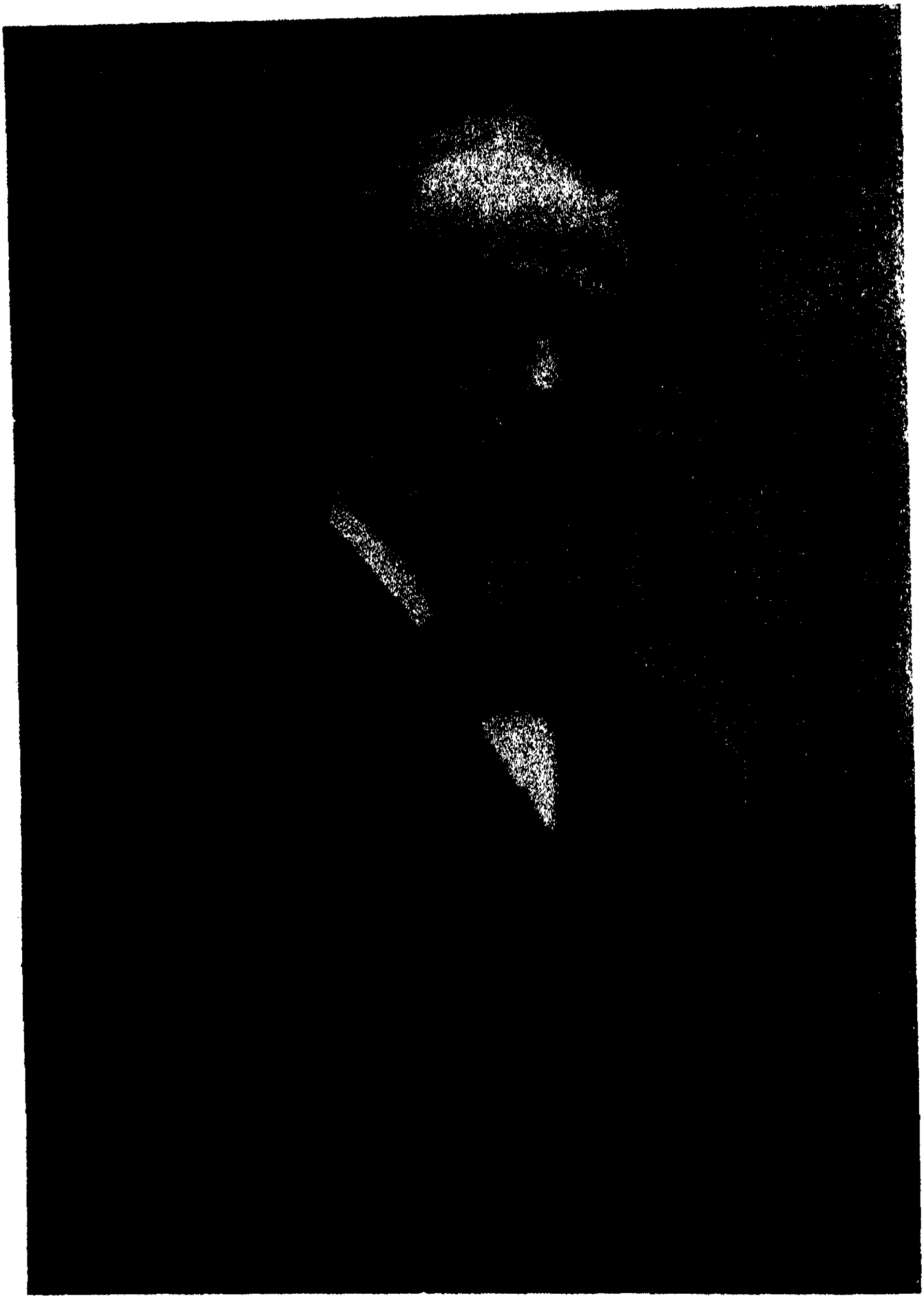
Mr. Hittell was a true Democrat of the sturdy and outspoken American type. When in college he did not join a Greek letter society because he thought these organizations were undemocratic. His hatred of despotism was never hidden under a bushel, but constantly burst forth in his writings and conversation.

He was a man of unswerving integrity of character, veracity of speech and sense of justice. He was tenacious, sometimes obstinate, in his attachment to his convictions; and where a question of right was concerned, he was immovable. When he was a young student he fell under the spell of Thomas Carlyle. Only a few weeks before his death he said

to the writer of these lines: "Whatever I may have of integrity of character, I owe to Carlyle. I became acquainted with his writings early in my life, and he has had the greatest influence over me of any man who ever wrote." Mr. Hittell was also sensibly molded by Carlyle's gospel of work; few men ever carried out so conscientiously the doctrine of unremitting, strenuous toil. Thus may we account for achievements in a single lifetime seldom exceeded in extent and excellence combined. He enjoyed his life to the full, and he had the proud consciousness of success in almost everything he undertook.

In his latest years, outside of his interest in the Academy, he was a spectator rather than a participant in public activities. In consequence, his opinions were not modified through actual friction with events, and he did not, from the standpoint of the present, keep up with the startling changes in modern methods and beliefs. To the unthinking or unimaginative, he was of the old school, of a past era, of ancient viewpoints. So, too, may we all, as the years draw to the end, be regarded by the rising generation as old-fashioned in principle and as unprogressive; and so, too, may we, in return, look upon the latest generation as too radical, unchristian, or even immoral. It is the way of all time. The new crowds out the old, and is in turn crowded out by the still newer. Each may be right in the light of his own time; for one day differeth from another in glory and in the shadows which it casts.

G. W. DICKIE,
LEVERETT MILLS LOOMIS,
RANSOM PRATT,
Committee.



CARL FUCHS

PROCEEDINGS

OF THE

CALIFORNIA ACADEMY OF SCIENCES

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II

IN MEMORIAM: CARL FUCHS

Born November 24, 1839—Died June 13, 1914

Carl Fuchs, well known as an entomologist, founder of the Brooklyn Entomological Society and the Pacific Coast Entomological Society, died on June 11, 1914, at his home in Alameda, California, at the good age of 74 years, 6 months and 17 days. He was a native of Hanan, Frankfurt-am-Main, Germany, where he was born on November 24, 1839. His remains were cremated in Oakland, California, at 2:30 p. m., June 13, 1914.

Mr. Fuchs attended grammar school in his native town until his fourteenth year, and from his very boyhood he had a great love for, and interest in, beetles and butterflies.

In 1853 he started to learn the trade of engraver and his apprenticeship lasted six years, still following in his spare time his hobby for insects.

It was in 1859 that he went as a first-class worker in his profession to Paris, France, where he remained for five years, and then he went to Madrid, Spain, for another year.

The year 1865 found him in the United States, and after one year with Tiffany's in New York, he opened his own business in the same city with two assistants and soon enjoyed a great reputation as an engraver and chaser. His work was always of the highest order.

June 17, 1918

He married Miss Marie Debold of New York City in 1867. One daughter was born to them, but she died at the age of nine years.

In 1872 Mr. Fuchs founded the Brooklyn Entomological Society with Professor Schaupp and others, and in the early years of that society he was connected with the publication of the first volume of a Bulletin that was important and of the greatest value to the society. From Mr. Fuchs's own account, it was evident that the pathway of the Bulletin was not of the easiest. But Mr. Leng states that it was the man's enthusiasm and business capacity that supplied much of its successful inception and vigorous growth, for they who worked together in that undertaking were "pushed forward by the buoyant nature of Mr. Fuchs."

In 1875 Mr. Fuchs returned to Germany for a visit to Frankfurt-am-Main, where he remained one year. He took his collection with him and made many friends among the entomologists. There he made the acquaintance of Professor Dr. von Hyden and of Professors Geminger and Harold, connected with the Lenkenburg Museum in Vienna. Another year he spent in Paris, France, where he was a daily visitor of Mr. Salle's and many collectors of fame, who enjoyed seeing a collection made in the United States of America. Mr. Fuchs was very liberal in distributing his duplicates and always ready to exchange.

In 1876 he first became acquainted with Mr. Charles Leng, who states that at that time Mr. Fuchs was in his prime, massive in figure, heavily bearded, strong and alert, German in his speech by preference, and well known locally for his large collection of Coleoptera, especially in the families Scarabæidæ and Lucanidæ.

Mr. Fuchs already had a beautiful collection, but he was very anxious to enlarge it, and was looking for new hunting grounds; so, in 1884, he made up his mind to go to Java.

He sold his home and business, but an earthquake occurring in Java at that time caused him to change his plans and he came to California.

He left New York on May 20, 1884, by way of Panama, with a fine recommendation to the captain of the ship in regard to his hobby. The captain let him off at many points

to collect, at one place taking him twenty miles inland. He had the captain and passengers so interested that everybody wanted to help him, and he obtained many interesting specimens. At Panama he had a four-day stop, which he employed in looking over the ruins of the Panama canal. He had with him a Mr. Slavin, a former engineer of the works, who showed him about. Mr. Fuchs was somewhat interested in the canal, as his brother had lost 75,000 francs in the unfortunate enterprise. This trip also resultd in his finding more insects.

After arriving in San Francisco, his first call was at the California Academy of Sciences, at that time located at California and Dupont streets. From that time on he kept in close connection with that institution. He was the only person who was allowed by the late Dr. Behr to handle his butterflies. He became a member of the Academy in 1890.

On August 7, 1901, Mr. Fuchs issued a call for the organization of an entomological society, as follows:

"With the view of organizing a Club of Entomologists on the Pacific Coast, for the purpose of promoting interest in entomological research, a meeting will be held at the California Academy of Sciences on Thursday, August 15, at 2 o'clock. You are urgently invited to attend."

That memorable meeting was attended by the following persons: Dr. H. H. Behr, W. G. W. Harford, Beverly Letcher, Prof. Wm. Ashmead, Carl Fuchs, Dr. E. C. Van Dyke, Professor H. C. Fall, F. W. Nunenmacher, and Dr. F. E. Blaisdell.

The meeting resulted in the founding of the California Entomological Club. At the fifth regular meeting of the club it was voted to change the name to the Pacific Coast Entomological Society, by which name it has been known ever since.

Mr. Fuchs was elected the first president of the society, a position which he filled until the 26th regular meeting, held November 27, 1907, when he requested to be relieved. He was succeeded by Dr. Edwin C. Van Dyke. The society prospered and grew under Mr. Fuchs's able leadership.

In 1908 he made a trip to the East for scientific purposes, but he visited only New York, Brooklyn and Washington. It

was at this time that Charles W. Leng saw him at the Imperial Hotel, on Fulton street, Brooklyn. Mr. Leng, in his "Recollections of Mr. Fuchs," says: "The great German, with his bushy hair and beard grizzled with age, put his arms about my neck and embraced the one who was a boy when he left New York. All who were present at that meeting will recall the boyish enthusiasm that made the old man so remarkable. Years had brought no noticeable slackening of the pace, no hesitation in action, speech or thought. Except for the gray hair, it was the same Fuchs who had been a leader among the founders of the Brooklyn Entomological Society. Tears, it is true, came to his eyes, as we recalled the names of those who had passed away, but they did not stay long, for his thoughts were not in the past but looking forward to the years to come, and to the things that he hoped to accomplish. He was a man of unusual vitality and personal magnetism, to whom hope and content were given in the fullest measure."

Mr. R. P. Dow says in regard to his visit to New York: "It was then that I met him. He had never seen a moving picture. We took him twice a day to the 'movies.' Coney Island was the place for them. All the afternoon and evening we mingled movies and beetle collecting under the arc lights. After all the years, many of the commonest insects were strange to Fuchs. So we took everything. At each capture Carl Fuchs would dip anew into a box of a particularly savory snuff, of a kind known only to himself. It had a delicious aroma, even if it did force a sneeze to all amateurs." Apparently those with him besides Mr. Dow were Chas. Schaeffer, Geo. P. Englehardt, Jacob Doll and Geo. Franck.

To us who were associated with Fuchs in recent years remains the duty to add our reminiscences to those already given. We all agree that he was the most kind, lovable and hospitable of men. We loved him not only for these traits, but also for his activity, energy and punctuality in business. He was noted everywhere for his enthusiasm in all matters appertaining to his favorite study. Mr. Fuchs was most happy when he was aiding some amateur, or his younger colleagues, by giving them material or advice.

By the earthquake and fire of 1906 he lost nearly all of his collection. This calamity nearly broke his heart; but,

with the kind assistance of his friends, he started a new one at once with all of his old-time energy.

Only those who were about him during that fearful calamity will ever realize the agony that he must have suffered when driven from his home on Kearny street—well do we remember the number, 212—leaving behind his collection containing a generic series which he took with him, hoping against hope that the remainder would be safe; and later the despair, when he realized that his life's work was in ashes. After a period of depression, his old-time energy revived and at the time of his death he had amassed another large collection.

His neatness and exactness in the preparation of entomological material was unique and characteristic of him. It gained for him the appointment of assistant curator in the entomological department of the California Academy of Sciences, where he worked up to the time of his last illness. After the San Francisco disaster, and while the Academy was unsettled, he received the appointment of preparator and assistant in the entomological department of the University of California, where he was known by the students as Professor Fuchs. When the California Academy of Sciences was again ready for his services he returned to it.

His widow, Marie Fuchs, who was a typical and devoted helpmate, could even excel her husband in the care and mounting of the coleopterous Pselaphidæ.

In the death of Mr. Fuchs, one of the last of a group of the older entomologists has passed away; to this group belonged Frederick Blanchard, Samuel H. Scudder, Henry Ulke, and Philip Uhler. The younger entomologists of the Pacific Coast, many of whom were his intimate friends, have ever been stimulated and enthused by his earnestness and example.

He was a member of the California Academy of Sciences, and also of the Deutsche Entomologische Gesellschaft of Berlin. In his earlier years he contributed short articles and notes to the Bulletin of the Brooklyn Entomological Society. In 1882 he published a synopsis of the Lucanidæ of the United States. Short papers were read by him before the Pacific Coast Entomological Society while president, which

have not appeared in print, but are filed in the archives of the society and it is hoped they may eventually be published.

At the fifty-third regular meeting of the latter society, Doctors Van Dyke and Blaisdell were appointed as a committee to draw up a set of resolutions, which were to be placed in the records of the society and copies of which were to be sent to his family. At the fifty-fourth meeting the following was presented by that committee:

"Whereas, in the fullness of time death has taken from us our most venerable member, Mr. Carl Fuchs, the organizer and a charter member of our society; and

"Whereas, Mr. Fuchs was held by us in the highest esteem for his devotion to entomology, as well as for his lovable personality and happy temperament; and

"Whereas, his personal enthusiasm has been ever a source of stimulus to develop entomology on the Pacific Coast and to aid his colleagues with advice and material, we shall mourn his loss; therefore, be it

"Resolved, that we publish a short sketch of his life in the Proceedings of the Society; and be it further

"Resolved, that we convey to his family our sympathy for its loss and our tribute to his industry and example; that we imitate his persistency in collecting and in the preparation of specimens."

(Signed) F. E. BLAISDELL,
E. C. VAN DYKE.

In the field, Mr. Fuchs was for years a keen collector, especially of the minute forms. No friend or stranger could refuse his enthusiastic request to gather insects for him. In this manner he kept up a constant influx of specimens. He was always on the *qui vive* to exchange for species not in his collection, and he was ever a source of supply of good things to correspondents far away. He was always happiest when showing his treasures, and with a characteristic twinkle in his eyes he would point out some very rare species.

Writers on Coleoptera kept in touch with him, as the writings of such men as Dr. Geo. Horn, Colonel Thos. L. Casey, Professor H. C. Fall, Mr. Chas. Leng, Dr. Walther Horn, and many others will show.

His first appearance in nomenclature was in connection with a Staphylinid named by G. Kraatz. He discovered that interesting little coleopteron which Dr. Geo. Horn called *Ægialites fuchsii.* Professor J. J. Rivers dedicated *Cychrus fuchsiana* to him. Brendel remembered him in the Pselaphidæ, and named *Brachycepsis fuchsii* and *Articerus* (*Fustiger*) *fuchsii* after him.

Mr. Fuchs supplied Colonel Casey with much material, as a perusal of that author's writings will show. He received credit for many forms described as new by Casey. In his revision of the Lathridiidæ of Boreal America, Professor Fall dedicated to him a genus, *Fuchsiana.* It was founded upon an unique blind Lathridiid collected while sifting earth and vegetable mould from about the roots of redwood trees near Mill Valley, Marin county, California. This genus is by far the most extraordinary of our North American Corticariini.

Mr. Fuchs was a most skillful preparator of insects; in fact, his work was unique and without equal for the care he bestowed upon both large and small specimens, which made the study of his material a joy to the taxonomist.

Mr. Fuchs also contributed much material and moral support to the author of the "Monographic Revision of the Eleodiini of the United States," in appreciation of which Dr. Blaisdell named *Eleodes fuchsii.*

So the last tribute to our friend and colleague is about to terminate. We have missed Mr. Fuchs when we have been assembled together to carry on entomological work; we have missed his kindly face and smile. Specimens of his handiwork are still with all of us and we prize them more than ever, now that he is gone. Yet we should in thankfulness remember that he had attained a goodly age, and that he was himself in spirit and personality to the last. We must reverence his patient and courageous meeting of the end of his labors. During our last moments of conversation he would pause and, with his chin resting in his hand, he would gaze through his study window into space with a serious and saddened look; but quickly the kindly smile returned and it did brighten our hearts, for he knew, and we knew, that the parting of the ways was at hand. We saw that there was no fear

in him to meet the last duty of time. Mr. Fuchs, our friend, is gone. We look in the direction in which he went, although the tears blind our eyes. The love we bore him and our memories of him are perpetual.

Frank E. Blaisdell, Sr.,
R. Benzinger,
Otto von Geldern,

Committee.

PROCEEDINGS

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III

SOME JAPANESE APHIDIDÆ[1]

BY

E. O. ESSIG AND S. I. KUWANA[2]

TABLE OF CONTENTS

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[1] After the submission of this paper to the California Academy of Sciences and before it could be published Prof. S. Matsumura's work entitled "A List of the Aphididæ of Japan, with Descriptions of New Species and Genera" appeared in the Journal of the College of Agriculture, Tohoku Imperial University, Vol. VII, pt. 6, pp. 351-414, Sapporo, July, 1917. In this paper several of the species which were previously described by the authors are named so that some changes are necessary. In all such cases the descriptions are included as originally written. Some uncertainty naturally exists as to other species, but extensive study and more specimens would be necessary for absolute certainty. It is remarkable that so few of our new species were described by Prof. Matsumura. This indicates the great number of Japanese species remaining to be worked up.

E. O. ESSIG.

Berkeley, Cal.,
Nov. 6, 1917.

[2] The arrangement of the authors' names is alphabetic.

Introduction

The following paper on "Some Japanese Aphididæ" has been prepared jointly by the authors as a small beginning to the study of this very interesting family in Japan. To the junior author belongs the part of collecting and preserving the material, taking full notes on color, localities, host plants, and dates of collection, as well as the packing and shipping of the material. The senior author is responsible for mounting the specimens on slides, determining the species, writing up the descriptions of new species, and making the drawings. It is to be regretted that distance and lack of time prevented sending the final manuscript to Dr. Kuwana for revision and correction. As the specimens were placed loosely in small vials of alcohol and were subjected to a long journey, many were entirely ruined, while others lost the legs, antennæ, wings, or other body parts. Every original lot, of which there were some 107, was given a collection number and accompanied with full field notes. All of the material was collected at or in the vicinity of Tokyo during the year 1913, and was received in several sendings during the latter part of that year and the first part of 1914. Because of the press of other duties, however, it was impossible to do anything with it until this late date. The Japanese, English and scientific names of the host plants are given wherever possible, the scientific names being revised according to the latest editions of the "Index Kewensis" by Hooker and Jackson and the "Encyclopedia of Horticulture" by Bailey.

Because the material represents such a very small part of the Japanese Aphid fauna, no attempt has been made to work out a scheme of classification and keys, but rather to give simply the notes and descriptions as clearly and briefly as possible. Drawings have been made to illustrate the more important characters and to supplement the descriptions. They are fully labeled so as to avoid lengthy explanations. The use of the camera lucida has made it possible to enlarge all to a common scale and they are so reproduced in the plates. Transferring the drawings by tracing paper has rectified the objects to their actual position on the slides.

In describing a new species it was thought best to set aside, wherever possible, a single representative individual as the type.

The winged viviparous female was selected in all such cases. Many of these types are not perfect but are fairly so. The other specimens of a lot from which a type was selected are designated as paratypes. Where no type could be decided upon the descriptions have been made, as is the usual custom, from a number of individuals, all of which are designated as cotypes. Types bear a red name label and the paratypes and cotypes yellow name labels. The types, representatives of all the cotypes and many of the paratypes, as well as other determined material received from Japan and discussed in this paper, have been presented to the California Academy of Sciences, Golden Gate Park, San Francisco, California, where they are housed in a substantial fireproof museum building accessible to all scientific workers. Duplicate material has also been presented to the Imperial University at Tokyo for the use of Japanese workers. The remainder of the material is in Professor Essig's collection.

ABBREVIATIONS USED IN FIGURES

A — apterous viviparous female
A ant.— antenna of apterous viviparous female
A ant. iii — article III of antennæ of apterous viviparous female
A ant. iv — article IV of antennæ of apterous viviparous female
A ant. v — article V of antennæ of apterous viviparous female
A ant. vi — " VI " " " " " "
A cauda — cauda of the apterous viviparous female
A corn. — cornicle of " " "
A head — head of the " " "
A hind t. — hind tarsi of the apterous viviparous female
A an. pl. — anal plate " " " " "
A pyg. — pygidium of the apterous viviparous female
W — winged viviparous female (abbreviations following this letter refer to the same parts as those of the apterous viviparous female already given above)
W wax pl. — wax plates of the winged viviparous female
Pro. tub. — prothoracic tubercle

HOST INDEX TO THE SPECIES LISTED

English, Japanese and Scientific names

Acer pictum Thunb. (Enkō Kaede)
  Chaitophorus japonica, new species
Aegle sepiaria DC. See *Poncirus trifoliata* Raf.
Alnus incana glauca Ait. (Yama hannoki)
  Euceraphis japonica, new species
Angelica polymorpha Maxim. (Shirane senkiu)
  Siphocoryne japonica, new species

Apple
  Aphis japonica, new species
    " *pomi* DeGeer
    " *somei,* new species
Artemisia vulgaris indica Maxim. (Yomogi)
  Macrosiphum absinthii (Linn.) ?
Asteromœa indica Bl. (Yomena). See *Boltonia indica* Benth.
Astragalus sinicus Linn. (Genge)
  Aphis medicaginis Koch
Boltonia indica Benth. (Yomena)
  Macrosiphum rudbeckiæ (Fitch)
  Rhopalosiphum, species
Brassica campestris Linn. (Natane-na) Mustard
  Rhopalosiphum persicæ (Sulzer)
Brassica chinensis Linn. (Aburana Pak-choi) Cabbage
  Aphis brassicæ Linn.
Castanea sativa Mill. (Kuri)
  Myzocallis kuricola (Mats.)
Castanea vulgaris japonica A. DC. See *C. sativa* Mill.
Castanopsis cuspidata Schot. (Shii)
  Eutrichosiphum passaniæ (Okajima)
  Nipponaphis cuspidatæ, new species
  Pterochlorus tropicalis Van der Goot
Celtis sinensis Pers. (Enoki)
  Chromaphis celticolens, new species
Chænomeles japonica Lindl. (Bake) Japonica or Japanese quince
  Aphis pomi DeGeer

Cherry
Aphis spinosula, new species
Aphis, species
Chrysanthemum (Kiku)
Aphis gossypii Glover
Macrosiphum nishigaharæ, new species
Cirsium japonicum DC. (Noazami). See *Cnicus japonicus* Maxim.
Citrus trifoliata Linn. (Karalachi). See *Poncirus trifoliata* Raf.
Clerodendron trichotomum Thunb. (Kusagi)
Aphis gossypii Glover
Cnicus japonicus Maxim. (Noazami)
Macrosiphum rudbeckiæ (Fitch)
Macrosiphum, species
Myzus, species
Cratægus cuneatus S. & Z.
Prociphilus cratægi Tullgren
Cucumis sativus Linn. (Kiuri) Cucumber
Aphis gossypii Glover
Cydonia japonica Pers. (Bake). See *Chænomeles japonica* Lindl.
Deutzia scabra Thunb. (Utsugi)
Aphis medicaginis Koch
Distylium racemosum S. & Z. (Isu)
Nipponaphis distylii Pergande
Euscaphis japonica Dipp. (Gonzui)
Rhopalosiphum indicum Van der Goot
Hibiscus syriacus Linn. (Mukuge) Shrubby Althea or rose of Sharon
Aphis medicaginis Koch
Hordeum sativum vulgare (Omugi). See *H. vulgare* Linn.
Hordeum vulgare Linn.
Aphis avenæ Fab.
Illicium anisatum Linn. (Skikimi)
Toxoptera aurantii Fonsc.
Ipomæa hederacea Jacq. (Asagao)
Rhopalosiphum magnoliæ, new species
Iris sanguinea Donn (Ayame)
Phorodon, species

Iris sibirica orientalis Thunb. (Ayame). See *I. sanguinea* Donn
Lactuca denticulata Maxim. (?) (Nigana) (*L. dentata* Makino?)
  Rhopalosiphum lactucæ (Kalt.)
Larix leptolepis Murr. (Kara-Mastu)
  Lachnus, species
Lespedeza bicolor Turc. (Hagi)
  Macrosiphum hagi, new species
  Rhopalosiphum lespedezæ, new species
Ligustrum ibota Sieb. (Ibota)
  Macrosiphum ibotum, new species
Magnolia conspicua Salisb. (Hakumokuren). See *M. denudata* Desr.
Magnolia denudata Desr. (Hakumokuren)
  Rhopalosiphum magnoliæ, new species
Magnolia hypoleuca S. & Z. (Hōnoki)
  Myzocallis, species
Magnolia kobus Thunb. (Kobushi)
  Calaphis magnoliæ, new species
Mespilus cuneatus S. & Z. (Sanzashi). See *Cratægus cuneatus* S. & Z.
Nelumbo nucifera Gaertn. (Hasu) East Indian lotus
  Rhopalosiphum nymphææ (Linn.)

Orange
  Aphis citricola Van der Goot
    " *gossypii* Glover
    " *somei,* new species
  Rhopalosiphum magnoliæ, new species
Osmanthus aguifolium B. & H. (Hiiragi)
  Prociphilus osmanthæ, new species
Pasania cuspidata Oerst. (Shii). See *Castanopsis cuspidata* Schot.

Peach (Momo)
  Myzus, species
  Rhopalosiphum nymphææ (Linn.)

Pear
  Anœcia piri (Mats.)

Pear, Japanese or Chinese
Aphis pomi DeGeer
" *siphonella,* new species
" *somei,* new species
Prociphilus pyri (Fitch)
Rhopalosiphum nymphææ (Linn.)
Toxoptera piricola Mats.
Petasites japonicus F. Schmidt (Fuki)
Aphis gossypii Glover
Pharbitis hederacea Jacq. (Asagao). See *Ipomœa hederacea* Jacq.
Pinus densiflora S. & Z. (Aka-matsu) Japanese red pine
Lachnus pinidensifloræ, new species
Platycodon grandiflorum DC. (Kikyo) Chinese or Japanese bellflower, Balloon flower.
Macrosiphum rudbeckiæ (Fitch)

Plum
Rhopalosiphum nymphææ (Linn.)
Podocarpus chinensis Wall. (Maki). See *P. macrophylla maki* Sieb.
Podocarpus macrophylla maki Sieb. (Maki)
Phyllaphis, species?
Poncirus trifoliata Raf. (Karalcahi) Trifoliate orange
Rhopalosiphum magnoliæ, new species
Poterium officinale A. Gray (Waremokau)
Aphis medicaginis Koch

Potato
Aphis gossypii Glover
Prunus mume S. & Z. (Ume) Japanese apricot
Rhopalosiphum nymphææ (Linn.)
Quercus dentata Thunb. (Kashiwa)
Myzocallis macrotuberculata, new species
Pterochlorus tropicalis Van der Goot
Quercus serrata Thunb. (Kunugi)
Myzocallis, species
" *capitata,* new species
" *kuricola* (Mats.)
Pterochlorus tropicalis Van der Goot
Trichosiphum kuwanai Pergande

Ranunculus ternatus Thunb. (Hi Ki-no-Kasa)
  Prociphilus populiconduplifolius (Cowen)?
Rhus javanica Linn. (Nurude)
  Aphis somei, new species
Rhus semialata Murr. (Nurude). See *R. javanica* Linn.

Rice

  Macrosiphum granarium (Kirby)
Rosa multiflora Thunb.
  Macrosiphum rosæ (Linn.)
Rumex crispus Linn. (Gishi-gishi)
  Aphis rumicis Linn.
Rumex japonicus Meisn. (Gishi-gishi). See *R. crispus* Linn.
Sagittaria sagittæfolia Linn. (Kuwai). Old world arrowhead
  Rhopalosiphum nymphææ (Linn.)
Salix, species (Yanagi)
  Siphocoryne bicaudata, new species
Salix multinervis F. & Sav. (Koriyanagi)
  Chaitophorus salijaponicus, new species
Sambucus racemosa Linn. Elder
  Rhopalosiphum magnoliæ, new species
Sanguisorba officinalis Linn. (Waremokau). See *Poterium officinale* A. Gray
Smilax china Linn. (Sarutori-ibara). See *S. walteri* Pursh.
Smilax walteri Pursh. (Sarutori-ibara)
  Aphis gossypii Glover?
Solanum melongena Linn. (Nasu)
  Aphis gossypii Glover
Sonchus oleraceus Linn. (Nogeshi). Sow thistle
  Rhopalosiphum lactucæ (Kalt.)
Staphylea bumalda DC. (Mitsuba Utsugi)
  Rhopalosiphum indicum Van der Goot

Strawberry

  Aphis, species
Thalictrum minus Linn. (Aki-Kara-matsu)
  Aphis thalictrii, new species
Tsuga sieboldi Carr. (Tsuga)
  Lachnus, species

Viburnum tomentosum Thunb. (Yabudomari)
Aphis somei, new species
Vicia faba equina Pers. (Soramame)
Aphis medicaginis Koch

Wheat
Aphis avenæ Fab.
Zelkova acuminata Planch. (Keyaki)
Aphis medicaginis Koch

NOMENCLATURE OF WING VENATION

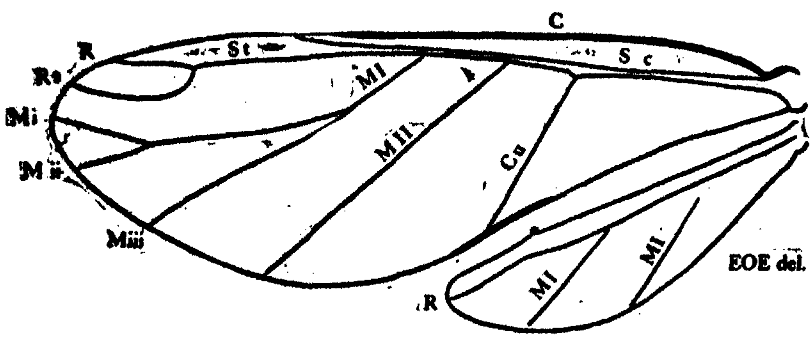

Figure 1.—Nomenclature of wing venation used in the text: C, costal; Cu, cubitus; M, media; R, radius; Rs, radial sector; Sc, subcostal; St, stigma or pterostigma. This form is the system usually used by European writers and by many others. (Original.)

NOTES AND DESCRIPTIONS

Macrosiphum absinthii (Linnæus)

One winged viviparous female and several apterous nymphs of what appears to be this species were taken on Yomogi, *Artemisia vulgaris indica* Maxim., at Nikko, June 19, 1913. Collection number 89. In comparison with determined specimens received from Prof. Theobald, England, there are not quite so many sensoria on article III of the antennæ and the cornicles are somewhat differently shaped, but in other respects they agree very well.

M. yomogicola Mats. may prove to be this species.

Macrosiphum granarium (Kirby)

A good series of this species was taken on rice plants, Nishigahara, Tokyo, Sept. 11, 1913. Collection number 103.

Macrosiphum hagi, new species

Figure 2

Winged viviparous female (Type)—One nearly perfect specimen. Length 1.2 mm., width 0.7 mm. Prevailing color dusky to dark green. Antennæ with few, short, knobbed hairs and black throughout excepting I, II and the extreme base of III; length of articles: I, 0.12 mm.; II, 0.05 mm.; III, 0.6 mm.; IV, 0.5 mm.; V, 0.43 mm.; VI, 1.02 mm. (base 0.2 mm., filament 0.82 mm.); total, 2.72 mm. Sensoria of III circular, of nearly the same size, in a row, and confined to the basal fifth. There are 12 on this article of each antenna; the normal number occurs on V and VI. Rostrum reaching to the 3rd coxæ. Prothorax yellowish green, meso- and metathorax lemon-yellow; coxæ, trochanters and bases of the femora and tibiæ pale, the remainder of the legs being black. Wings with dark veins; primaries 3.2 mm. in length. Cornicles faintly imbricated, pale with black tips, 0.5 mm. long. Cauda pale green, 0.25 mm. long.

Apterous viviparous females (Paratypes)—Three good specimens. Average length 1.1 mm., width 0.7 mm. General color green. Antennæ black, except I, II and most of III, which are pale green, imbricated and with few short thick or knobbed hairs; lengths of articles: I, 0.1 mm.; II, 0.05 mm.;

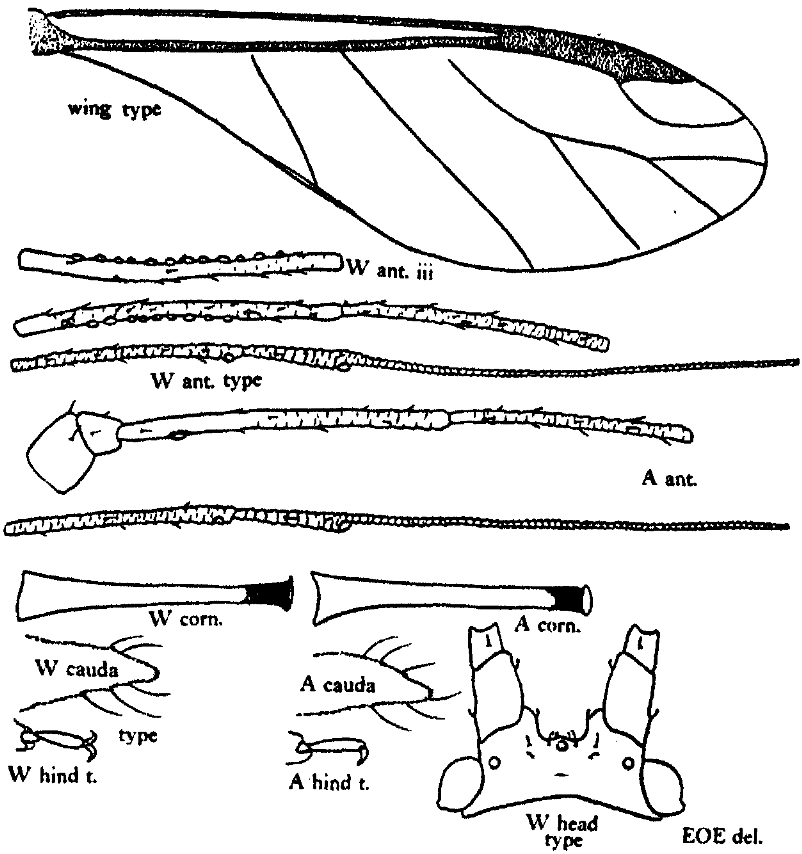

Figure 2.—*Macrosiphum hagi*, new species

III, 0.6 mm.; IV, 0.45 mm.; V, 0.42 mm.; VI, 1 mm. (base 0.2 mm., filament 0.8 mm.); total 2.62 mm. Article III of each specimen with a single large sensorium near the base; sensoria on other articles normal. Rostrum extending to the base of the abdomen. Cornicles dusky with black tips, faintly imbricated, 0.5 mm. long. Cauda pale green, 0.23 mm. long.

NYMPHS—pale green throughout.

HOST PLANT—Hagi, *Lespedeza bicolor* Turc.

LOCALITY—Tokyo.

DATE OF COLLECTION—May 14, 1913.

COLLECTION NUMBER—32.

Note—This may possibly be *M. hagicola* Mats., but the descriptions differ considerably.

Macrosiphum ibotum, new species

Figure 3

Winged viviparous female (Type)—Selected from 12 individuals in good condition. Length 2 mm., width (of a paratype) 0.9 mm. General color pale green. Antennæ black throughout excepting I and II which are dusky, with few hairs, and imbricated; lengths of the articles: I, 0.12 mm.; II, 0.09 mm.; III, 0.71 mm.; IV, 0.58 mm.; V, 0.51 mm.; VI, 1.67 mm. (base 0.17 mm., filament 1.5 mm.); total 3.68 mm. Sensoria of article III circular, about the same size, almost in a row and 16 in number. Paratypes show a variation in number from 13 to 16. Sensoria on other articles normal. Rostrum reaching nearly to the 3rd coxæ. Prothorax yellowish, the remainder of the thorax dark. Legs yellow, with the distal ends of the femora and tibiæ and all of the tarsi black. Front wings 3 mm. long. Cornicles dark, imbricated throughout, 0.42 mm. long (of a paratype 0.52 mm. long). Cauda dark, 0.23 mm. long.

Apterous viviparous females (Paratypes)—Seven individuals in good condition. Average length 1.8 mm., width 1 mm. Prevailing color pale green. Antennæ dark, except I, II and the base of III; imbricated, with a few short hairs; lengths of articles: I, 0.15 mm.; II, 0.07 mm.; III, 0.77 mm.; IV, 0.61 mm.; V, 0.51 mm.; VI, 1.45 mm. (base 0.15 mm., filament 1.30 mm.); total 3.56 mm. Sensoria small, circular, normal on V and VI; varying from none to 3 on III, and confined to the base. Rostrum pale, reaching nearly to the third coxæ. Abdomen pale, with darker green spots on the dorsum. Cornicles black, finely imbricated throughout, 0.53 mm. long. Cauda pale, 0.32 mm. long.

Nymphs—Paler in color than the adults with the wingpads dusky.

Host plant—On the undersides of the leaves of Ibota, *Ligustrum ibota* Sieb.

Locality—Nakano, Tokyo.

Date of collection—May 25, 1913.

Collection number—59.

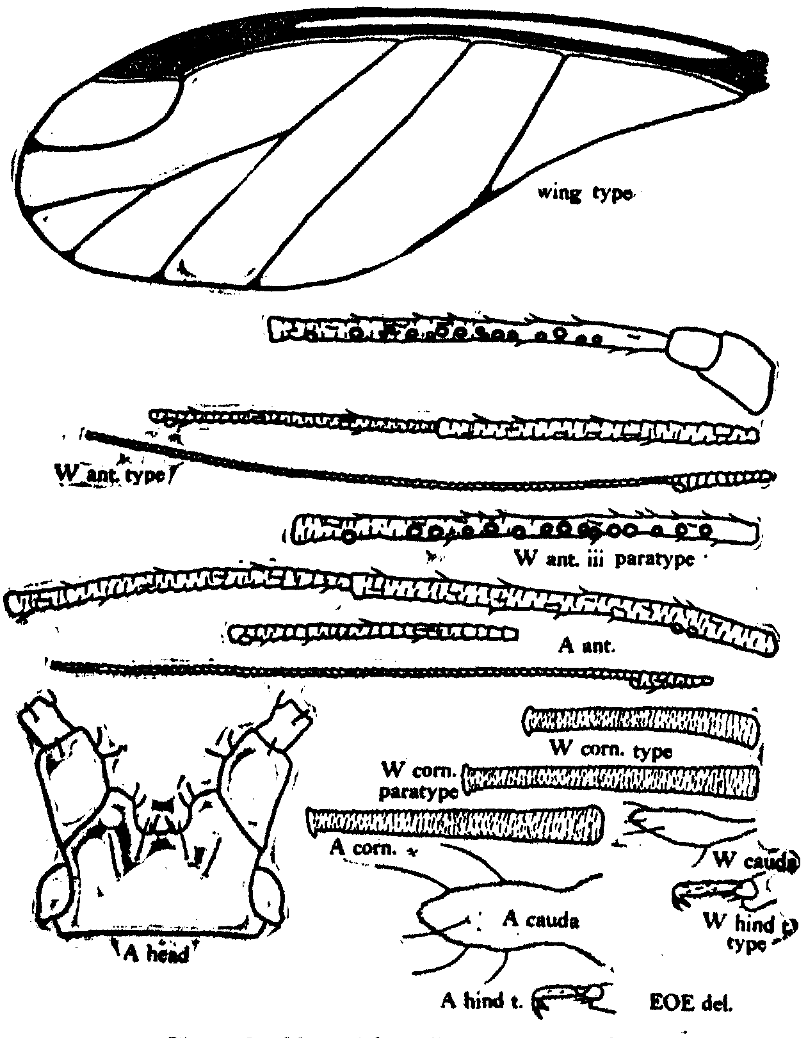

Figure 3.—*Macrosiphum ibotum*, new species

Macrosiphum nipponicum, new species

Figure 4

Winged viviparous female (Type)—Selected from 5 individuals. Length 1.7 mm., width 0.09 mm. Prevailing color bright shiny crimson-lake. Antennæ dusky, with I and II black, III-VI with black apices, few short hairs or knobbed spines, imbricated; lengths of articles: I, 0.10 mm.; II, 0.07 mm.; III, 0.62 mm.; IV, 0.48 mm.; V, 0.50 mm.; VI, 0.97 mm. (base 0.17 mm., filament 0.80 mm.); total 2.74 mm. Sensoria circular. On III there are 8 (left) and 7 (right) in a row. Paratypes show a variation of from 7 to 9 which are usually confined to the basal two-thirds of the article. Rostrum reaching about to the 2nd coxæ. Coxæ and trochanters pale-brown, femora brown, with their apical halves black, tibiæ amber with both ends black, tarsi all black. Front wings 3.7 mm. long. Abdomen bright crimson-lake with black markings on the dorsum. Cornicles black, imbricated at the tips, 0.48 mm. long (of a paratype 0.55 mm. long). Cauda dusky or black (of a paratype) 0.23 mm. long.

Apterous viviparous females (Paratypes)—Six individuals. Length 1.8 mm., width 1.2 mm. Prevailing color bright crimson-lake. Head dusky. Antennæ imbricated; articles I, II, V and VI black; III and IV pale with black apices; lengths of articles: I, 0.15 mm.; II, 0.09 mm.; III, 0.65 mm.; IV, 0.49 mm.; V, 0.41 mm.; VI, 0.85 mm. (base 0.16 mm., filament 0.69 mm.); total 2.68 mm. From 1 to 3 large circular sensoria near the base of III. Rostrum reaching nearly to the 3rd coxæ. Prothorax dusky, the rest of the thorax bright shiny crimson-lake. Abdomen same color with black markings on the dorsum. Cornicles black, imbricated at the tips, 0.63 mm. long. Cauda dark, 0.24 mm. long.

Host plant—Not given.
Locality—Kurayamizaka, Nishigahara, Tokyo.
Date of collection—May, 1913.
Collection number—24.

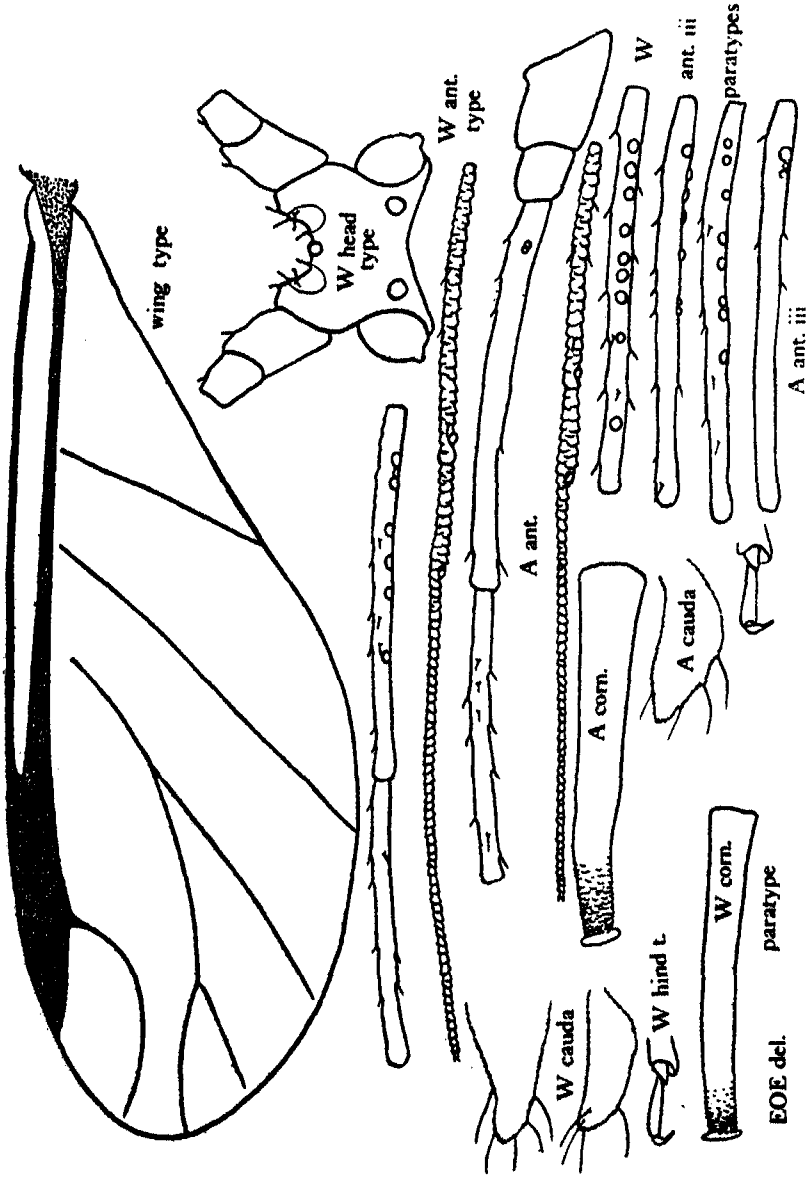

Figure 4.—*Macrosiphum nipponicum*, new species

Macrosiphum nishigaharæ, new species

Figure 5

WINGED VIVIPAROUS FEMALE (Type)—From four imperfect specimens. Length 1.75 mm., width 0.8 mm. Prevailing color shiny dark purple-lake to black. Antennæ with fairly long knobbed hairs, imbricated towards the tips; black, except basal half of III which is pale brown; lengths of the articles: I, 0.11 mm.; II, 0.08 mm.; III, 0.6 mm.; IV, 0.38 mm.; V, 0.35 mm.; VI, 0.73 mm. (base 0.13 mm., filament 0.6 mm.); total 2.25 mm. Sensoria on III circular, of different sizes and scattered, 26 (left) and 28 (right). On the paratypes the number varies from 29 to 32. On IV 8 (left). On the paratypes from 3 to 9. The usual number on V and VI. Rostrum dark, extending to the 3rd coxæ. Thorax shiny black, with small lateral prothoracic tubercles. Legs black with the base of the femora and middle of the tibiæ pale. Front wings 2.6 mm. long. Abdomen dark shiny purple or black. Cornicles short, black, somewhat constricted beyond the middle, basal third imbricated, remainder reticulate, 0.26 mm. long. Cauda black, slightly longer than the cornicles or 0.29 mm.

APTEROUS VIVIPAROUS FEMALES (Paratypes) — Selected from ten specimens. Average length 1.6 mm., width 0.8 mm. Prevailing color from shiny carmine to dark purple-lake or black. Antennæ black except the basal two-thirds of III, with numerous knobbed hairs; lengths of articles: I, 0.08 mm.; II, 0.08 mm.; III, 0.58 mm.; IV, 0.41 mm.; V, 0.31 mm.; VI, 0.61 mm. (base 0.12 mm., filament 0.49 mm.); total 2.07 mm. The sensoria on III are circular, of different sizes, confined in a row to the middle region or along the entire length of the article and varying in number from 12 to 21, the majority having 16. Rostrum reaching slightly beyond the 3rd coxæ. Prothoracic lateral tubercles small but distinct. Cornicles black, short, slightly constricted before the end, basal one-third imbricated, the remainder reticulate, 0.27 mm. long. Cauda black, 0.35 mm. long.

HOST PLANT—Kiku, *Chrysanthemum*, species.
LOCALITY—Nishigahara, Tokyo.
DATE OF COLLECTION—May 9, 1913.
COLLECTION NUMBER—10.

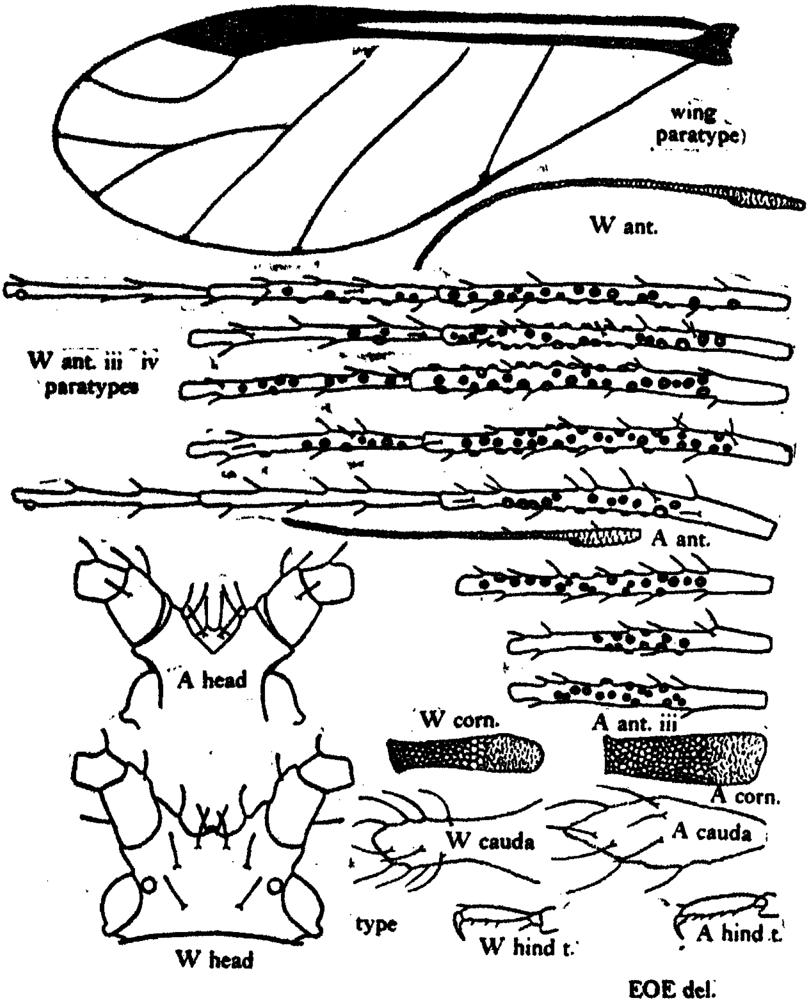

Figure 5.—*Macrosiphum nishigaharæ*, new species

Macrosiphum rosæ (Linn.)

The alcoholic specimens do not show the typical black markings on the legs of all, but check up well in all other respects. Taken on *Rosa multiflora* Thunb., Tokyo, May 14, 1913. Collection number 34. A slide of specimens labeled *M. rosæformis* Das, taken at Lahore, India, Jan. 7, 1914, by Mr. Das appears to be small individuals of this species.

Macrosiphum rudbeckiæ (Fitch)

Figures 6 and 7

Five collections of this species were made as follows:

1. On Yomena, *Boltonia indica* Benth. (listed as *Asteromœa indica* Bl.), Nishigahara, Tokyo, May 12, 1913. Collection number 25.
2. On Noazami, *Cnicus japonicus* Maxim. (listed as *Cirsium japonicum* DC.), Nishigahara, Tokyo, May 12, 1913. Collection number 26.
3. Host plant not given. Nishigahara, Tokyo, June 5, 1913. Collection number 73.
4. On Kikyo (Japanese or Chinese Bellflower, Balloon Flower), *Platycodon grandiflorum* DC., Tokyo, June 5, 1913. Collection number 75. These specimens were smaller than normal.
5. On *Boltonia indica* Benth., Nishigahara, Tokyo, Aug. 4, 1913. Collection number 102.

In comparing this species with the descriptions and drawings of the European, *M. solidaginis* (Fab.), it is found they are certainly very close if not the same thing. It also appears to be what Matsumura has determined as *M. chrysanthemi* Del Guercio.

Macrosiphum, species

Apterous viviparous examples only of this species were taken. The color is given as cobalt-lemon. The antennæ are very long, dusky or black with from 5 to 6 sensoria near the base of article III. The basal third of the cornicles is yellow, the remainder black. The length is about twice that of the cauda, which is pale. The length of the body is 2.5 mm., the width 1.5 mm. Collected on Noazami, *Cnicus japonicus* Maxim. (listed as *Cirsium japonicum* DC.), Nishigahara, Tokyo, June 5, 1913. Collection number 72.

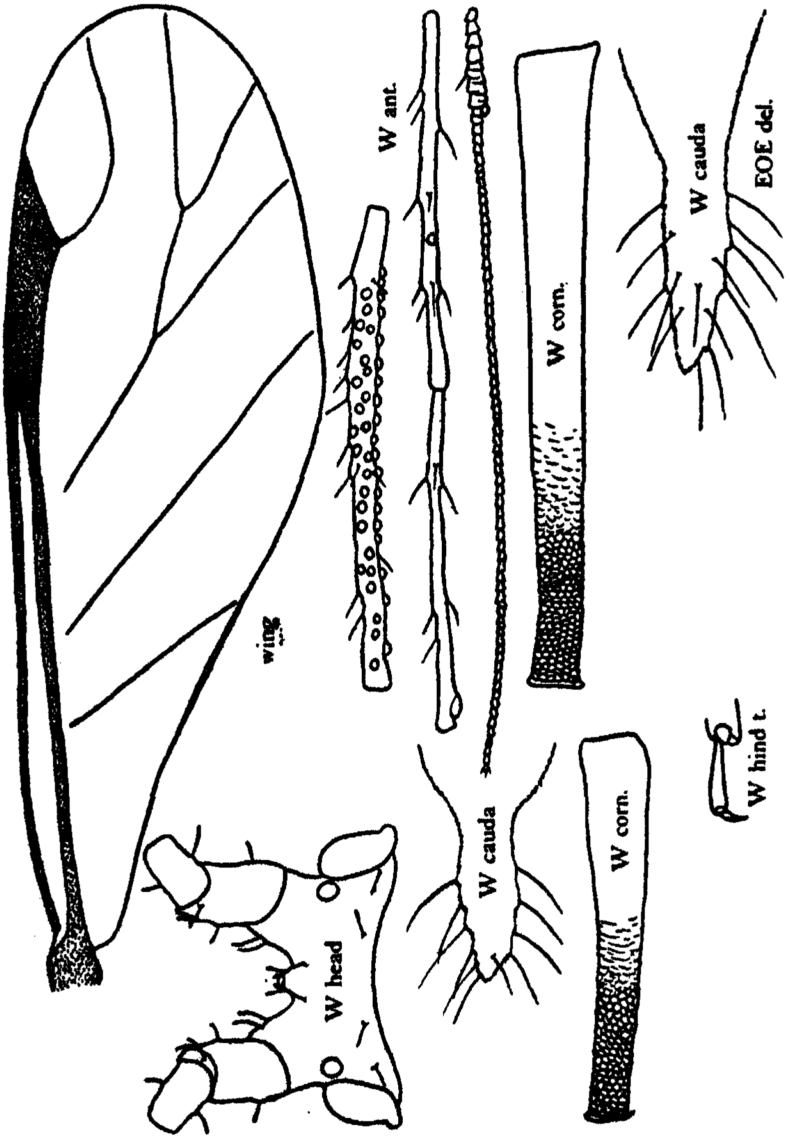

Figure 6.—*Macrosiphum rudbeckiæ* (Fitch). Winged viviparous female

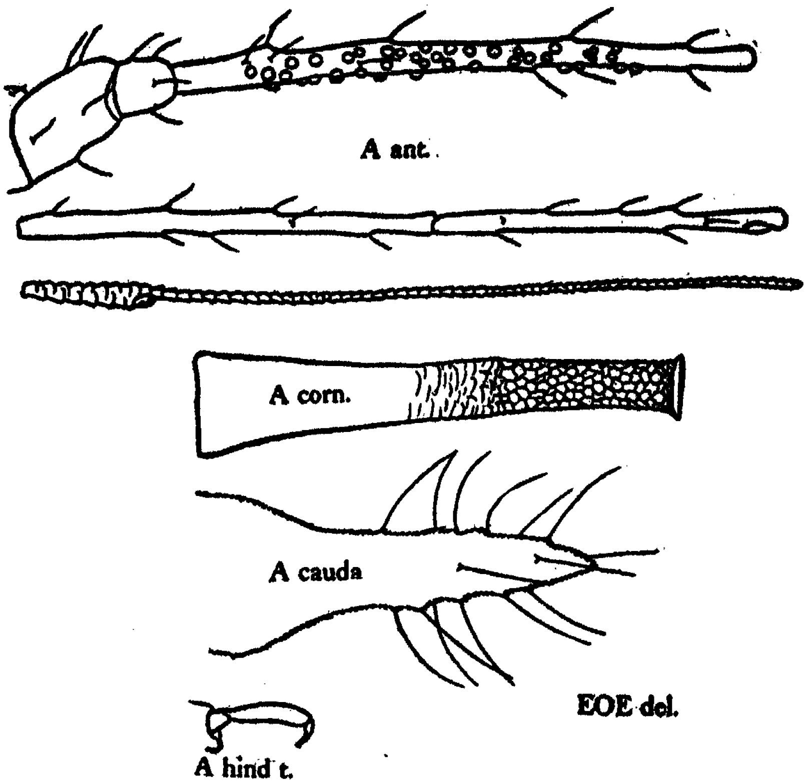

Figure 7.—*Macrosiphum rudbeckiæ* (Fitch). Apterous viviparous female.

Macrosiphum, species

This is a large bright yellow species represented only by apterous viviparous females. The antennæ are black with from 1 to 4 sensoria near the base of III. Cornicles black, slightly constricted near their tips, 0.2 mm. long. Cauda yellow, 0.12 mm. long. Length of body 2.2 mm., width 1.3 mm. On Noazami, *Cnicus japonicus* Maxim. (listed as *Cirsium japonicum* DC.), Tokyo, Aug. 4, 1913. Collection number 100.

Myzus, species

A few apterous viviparous females of a green species were taken on Momo (peach tree), Nishigahara, Tokyo, May 15, 1913. Collection number 43.

Myzus, species

Only apterous females were taken. They are very pale transparent-yellow, 1.1 mm. long and with many knobbed hairs on the body. The cornicles are pale and 0.5 mm. long. On Noazami, *Cnicus japonicus* Maxim. (listed as *Cirsium japonicum* DC.), Nishigahara, Tokyo, June 5, 1913. Collection number 74.

Phorodon, species

A pale green species represented by a few apterous viviparous females. Taken on Ayame, *Iris sanguinea* Donn (listed as *I. sibirica orientalis* Thunb.), Komagome, Tokyo, May 11, 1913. Collection number 23.

Rhopalosiphum indicum Van der Goot

Figure 8

1916—Rec. Ind. Mus., vol. 12, pt. 1, no. 1, pp. 1-3, fig. 1. Feb. (Orig. desc.)

The apterous viviparous females agree so well with the description of the above that we have no hesitancy in so designating them. As no description of the winged viviparous female has ever been published the following has been prepared:

WINGED VIVIPAROUS FEMALE—Length 3.2 mm., width 1.5 mm. Prevailing color orange. Antennæ black, with articles I, II and base of III dusky-yellow; lengths of articles: I, 0.19 mm.; II, 0.09 mm.; III, 1.04 mm.; IV, 0.82 mm.; V, 0.54 mm.; VI, 0.71 mm. (base 0.15 mm., filament 0.56 mm.); total 3.39 mm. The sensoria on article III are circular, of various sizes, scattered along the full length, and varying in number on different individuals from 50 to 70. Article IV normally has none, but may have from 1 to 3; V and VI have the usual number. Rostrum yellow, reaching to the 2nd coxæ. Veins of the front wings narrowly bordered with dusky brown, length 6 mm. Coxæ, trochanters and bases of the femora lemon-yellow, the remainder of the legs black. Cornicles black, widest near the middle and narrow at both ends, the apical end being

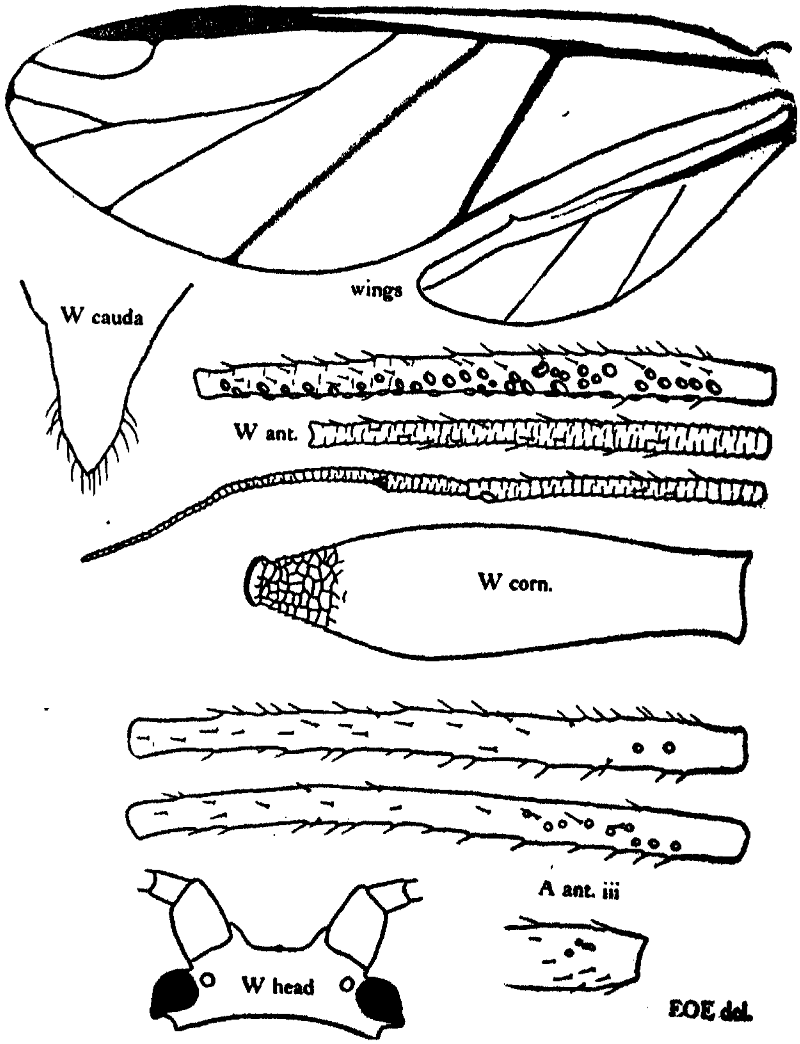

Figure 8.—*Rhopalosiphum indicum* Van der Goot

smallest and reticulate for a short distance as shown in the accompanying drawing. Cauda dusky orange, 0.4 mm. long.

This material, which comprises a good series, was taken in two lots as follows:

1. On Gonzui, *Euscaphis japonica* Dipp., Somei, Tokyo, May 7, 1913. Collection number 1.
2. On Mitsuba Utsugi, *Staphylea bumalda* DC., Nikko, June 9, 1913. Collection number 81. These specimens average larger in size than those of the first lot and were the ones from which the measurements were taken.

Rhopalosiphum lactucæ (Kalt.)

Two lots of apterous viviparous females which check up very well with this species were taken as follows:

1. On Nigana, *Lactuca denticulata* Maxim.? (listed as *L. dentata* Makino), Tokyo, May 17, 1913. Collection number 37.
2. On Nogeshi (sow thistle), *Sonchus oleraceus* Linn., Nakano, Tokyo, May 26, 1913. Collection number 62.

Rhopalosiphum lespedezæ, new species

Figure 9

WINGED VIVIPAROUS FEMALE (Type)—Selected from four imperfect individuals. Length 1.28 mm., width 0.68 mm. Prevailing color green. Head brownish or dusky. Antennæ dusky or black throughout, imbricated, with a few short clubbed or thick hairs; lengths of articles: I, 0.11 mm.; II, 0.09 mm.; III, 0.53 mm.; IV, 0.51 mm.; V, 0.43 mm.; VI, 0.74 mm. (base 0.14 mm., filament 0.6 mm.); total 2.41 mm. The sensoria vary somewhat in size, there being 12 on article III of the left antenna and the usual number on V and VI. Paratypes show a variation in number from 11 to 15 on III and from 0 to 4 on IV. Those which do occur on IV are mostly small. Rostrum reaching to the 3rd coxæ. Apical portion of the femora and tibiæ and all of the tarsi black, the remainder of the legs pale. Primary wings 2.66 mm. long, with the base of the radial sec-

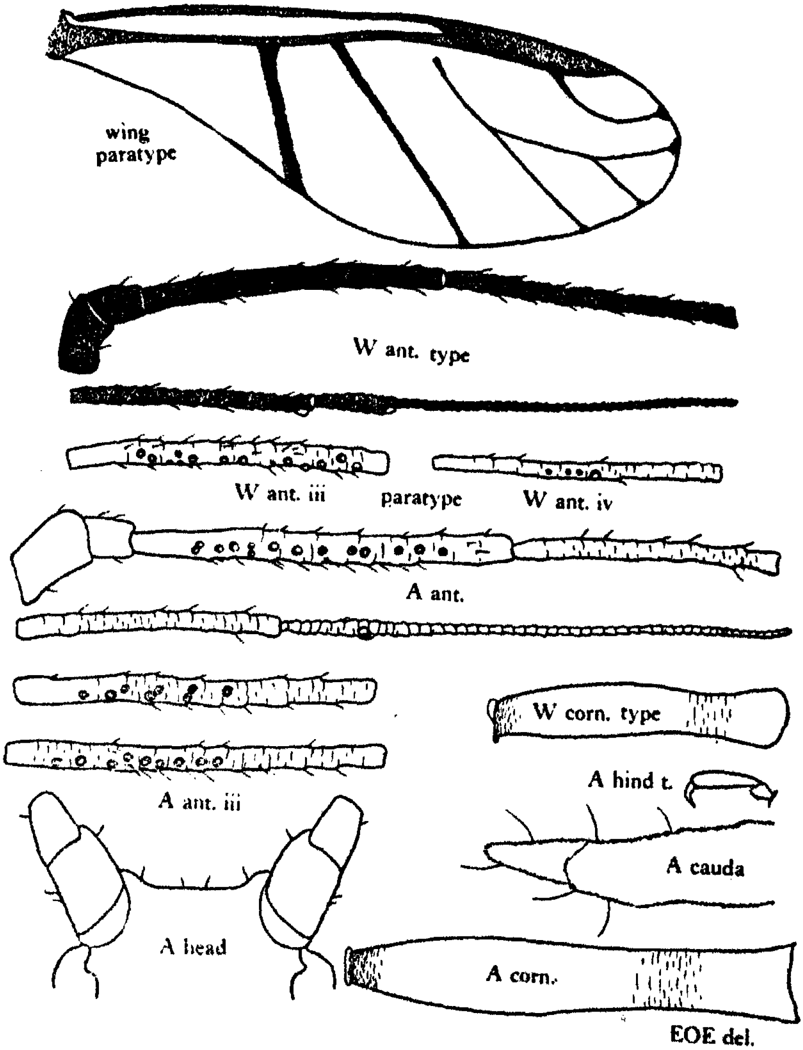

Figure 9.—*Rhopalosiphum lespedezæ*, new species

tor and all of the cubitus and media veins distinctly clouded as shown in the illustration. Abdomen green with dusky transverse markings on the dorsum, and several pairs of lateral tubercles. Cornicles black, somewhat constricted near the base and largest beyond the middle, with a small mouth; imbricated at the basal constrictions and near the tips; length 0.51 mm. Cauda green and slightly shorter than the cornicles.

APTEROUS VIVIPAROUS FEMALES (Paratypes)—Some thirty good specimens. Average length 1.7 mm., width 1.2 mm. Prevailing color green. Head brownish green or pale brown. Antennæ dark to black throughout and imbricated; lengths of articles: I, 0.14 mm.; II, 0.07 mm.; III, 0.67 mm.; IV, 0.41 mm.; VI, 0.9 mm. (base 0.17 mm., filament 0.73 mm.); total 2.6 mm. Article III has from 8 to 15 (majority with 10) large and small sensoria throughout the length or confined to the basal two-thirds. Rostrum extending to, or nearly to, the 3rd coxæ. Thorax and abdomen green, the red eyes of the unborn young showing through the latter and giving the appearance of red spots on the dorsum; sides of the abdomen with several pairs of lateral tubercles. Cornicles black, faintly imbricated and constricted, 0.78 mm. long. Cauda paler than the abdomen and with a dusky tip, 0.5 mm. long.

HOST PLANT—Hagi, *Lespedeza bicolor* Turc.
LOCALITY—Komagome, Tokyo.
DATE OF COLLECTION—May 8, 1913.
COLLECTION NUMBER—5.

Rhopalosiphum magnoliæ, new species

Figures 10 and 11

WINGED VIVIPAROUS FEMALES (Cotypes)—A large number of winged specimens were received, but so many had missing appendages, chiefly antennæ, that no type was selected; hence all are designated as cotypes. Average length 2.2 mm., width 1.05 mm. Prevailing color green. Head pale to bright red. Antennæ black throughout, imbricated, with few short hairs; lengths of articles: I, 0.15 mm.; II, 0.10 mm.; III, 0.92 mm.; IV, 0.71 mm.; V, 0.59 mm.; VI, 1.02 mm. (base 0.24 mm., filament 0.78 mm.); total 3.49 mm. Sensoria on III scattered

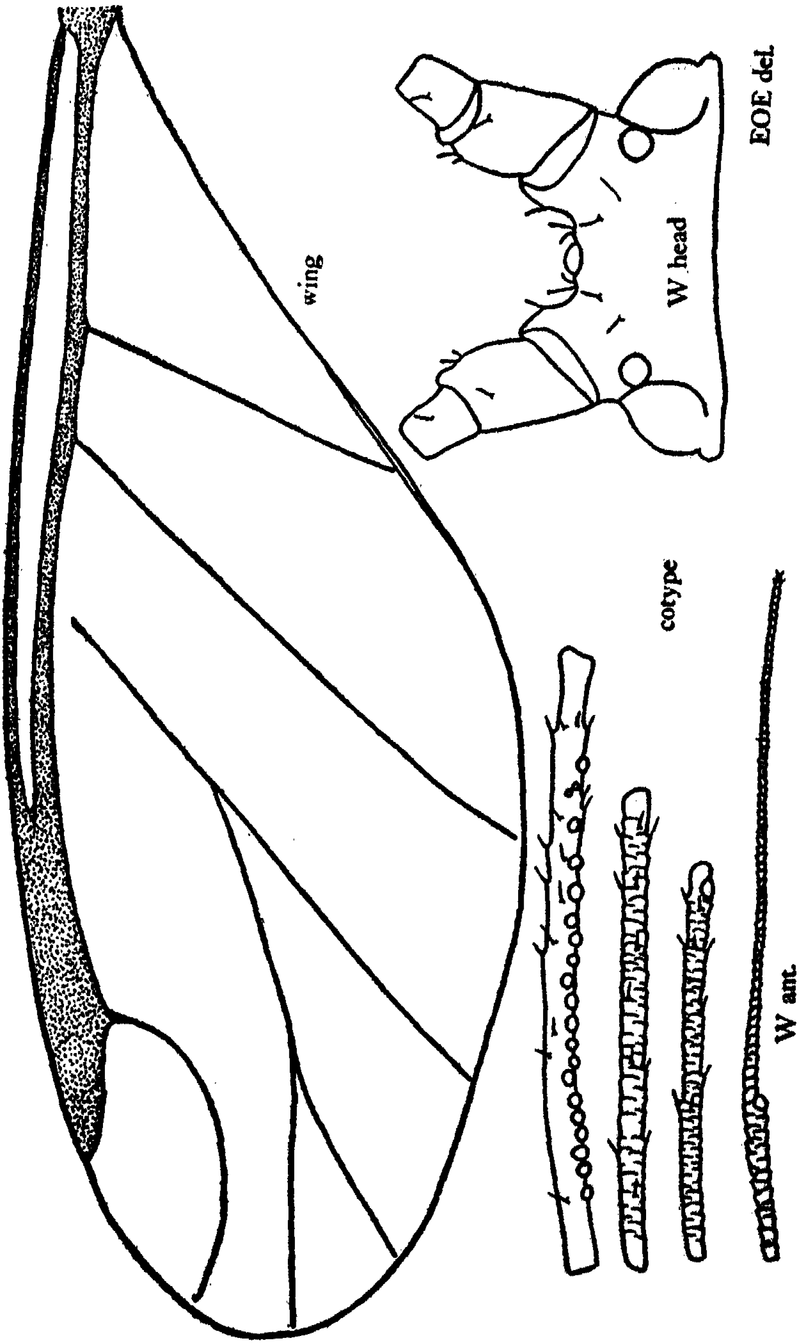

Figure 10.—*Rhopalosiphum magnoliæ*, new species

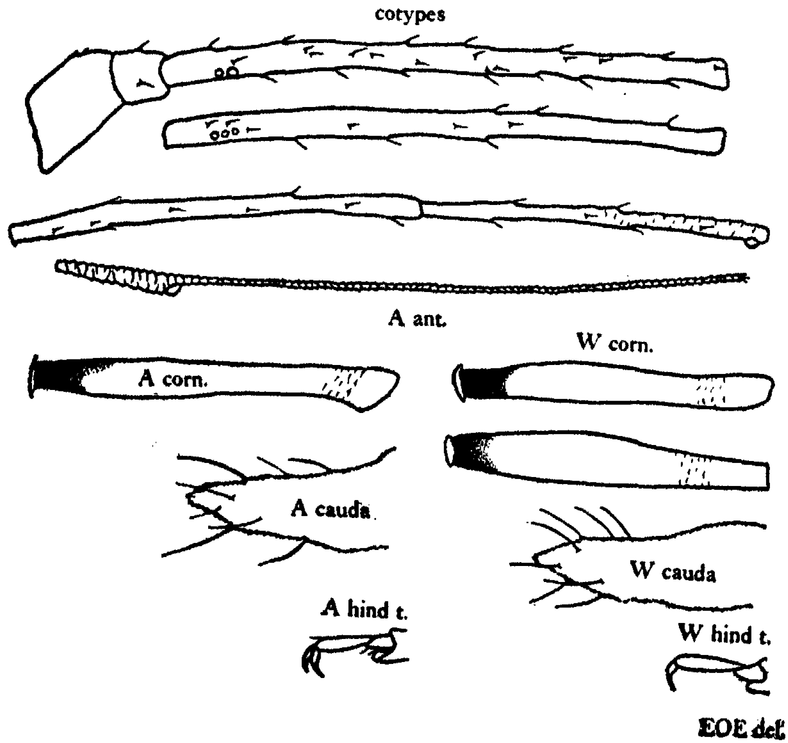

Figure 11.—*Rhopalosiphum magnoliæ*, new species

or almost in a row, varying from 14 to 24 in number. Rostrum dark, extending nearly to the 2nd coxæ. Prothorax pale reddish, remainder of thorax brownish-green. Coxæ, trochanters and bases of the femora pale green; all other parts of the legs black. Veins of the wings pale brown; length of the front wings 4.6 mm. Abdomen green. Cornicles pale green with dusky or black tips, faintly imbricated near bases and tips, 0.56 mm. long. Cauda dusky, 0.4 mm. long.

APTEROUS VIVIPAROUS FEMALES (Cotypes)—A large number of individuals. Average length 1.8 mm., width 1 mm. Prevailing color green with the head and thorax reddish brown or amber. Antennæ dark or black throughout, imbricated, with few short hairs; lengths of articles: I, 0.16 mm.; II, 0.08 mm.; III, 0.99 mm.; IV, 0.71 mm.; V, 0.6 mm.; VI, 1.21 mm. (base 0.22 mm., filament 0.99 mm.); total 3.75 mm.

There are from 1 to 3 small sensoria near the base of III. Cornicles same as in winged forms, 0.63 mm. long. Cauda dusky, 0.36 mm. long.

NYMPHS—Pale green with dusky legs and antennæ.

HOST PLANTS, LOCALITIES, ETC.—The species has been taken on a number of occasions as follows:

1. On Habumokuren, *Magnolia conspicua* Salisb., Nishigahara, Tokyo, May 12, 1913. Collection number 30.
2. On Karalachi (trifoliate orange), *Poncirus trifoliata* Raf. (listed as *Aegle sepiaria* DC. or *Citrus trifoliata* Linn.), Nishigahara, Tokyo, May 15, 1913. Collection number 42.
3. On orange, Shizzuoka-Ken, May 18, 1913. Collection number 50.
4. On Karalachi and on Asagao, *Ipomœa hederacea* Jacq. listed as *Pharbitis hederacea* Jacq.), Tokyo, May 22, 1913. Collection number 51.

Rhopalosiphum nymphææ (Linn.)

Figure 12

This species is apparently quite common in the vicinity of Tokyo, having been taken on a number of host plants as follows:

1. On Ume (Japanese apricot), *Prunus mume* S. & Z., Komagome, Tokyo, May 9, 1913. Collection number 8.
2. On Ume, Nishigahara, Tokyo, May 11, 1913. Collection number 17.
3. On plum, Nishigahara, Tokyo, May 11, 1913. Collection number 18.
4. On Japanese pear, Nishigahara, Tokyo, May 11, 1913. Collection number 19.
5. On peach, Nishigahara, Tokyo, May 11, 1913. Collection number 21.
6. On Kuwai (old world arrowroot), *Sagittaria sagittæfolia* Linn., and on Hasu (East Indian lotus), *Nelumbo nucifera* Gaertn., Tokyo, June 23, 1913. Collection number 91.

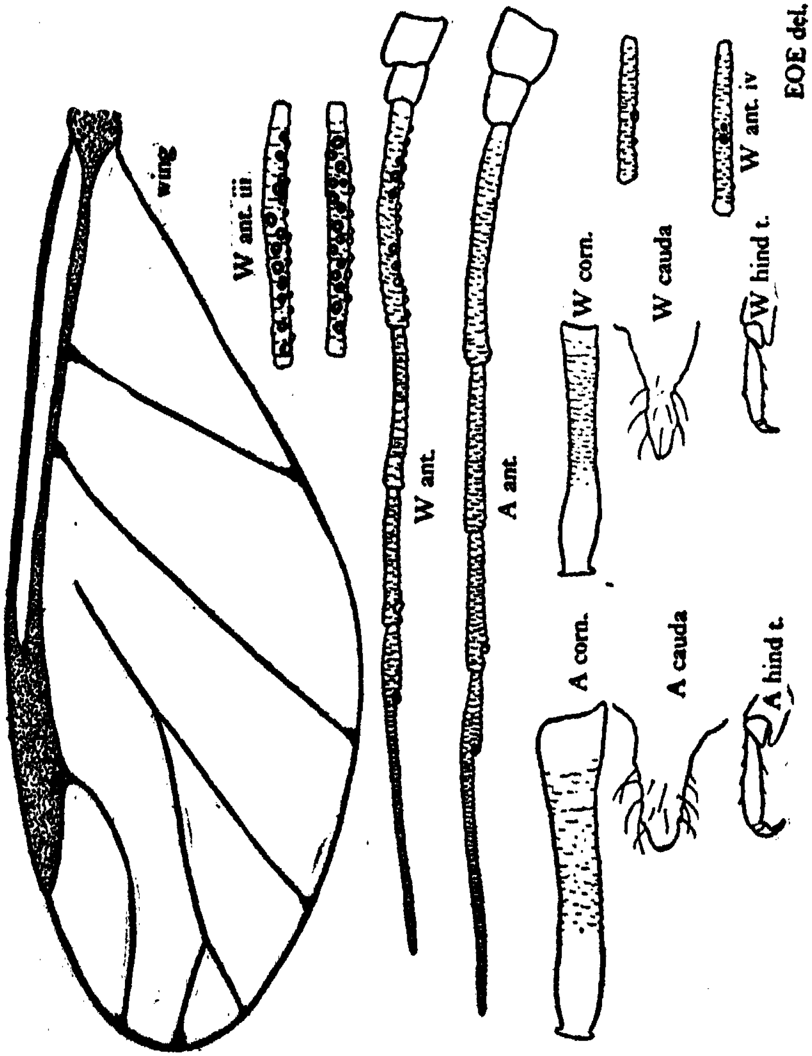

Figure 12.—*Rhopalosiphum nymphææ* (Linnæus)

Rhopalosiphum persicæ (Sulzer)

This species was taken on Natane-na (mustard), *Brassica campestris* Linn., Shiga-Ken, May 23, 1913. Collection number 55.

Rhopalosiphum, species

Only two immature apterous females of this species were received and they are in very poor condition. The color is lemon-yellow with pale and dusky antennæ, dark brown cornicles and lemon-yellow cauda. Occurs on Yomena, *Boltonia indica* Benth. (listed as *Asteromœa indica* Bl.), Somei, Tokyo, May 10, 1913. Collection number 12.

Siphocoryne bicaudata, new species

Figure 13

Winged viviparous females (Cotypes)—Three specimens, one without antennæ, the other two in fair condition. Length 1.25 mm., width 0.7 mm. Color not given, apparently black and green. Antennæ dusky to black throughout, imbricated and with few hairs; lengths of articles: I, 0.05 mm.; II, 0.04 mm.; III, 0.3 mm.; IV, 0.15 mm.; V, 0.11 mm.; VI, 0.25 mm. (base 0.11 mm., filament 0.14 mm.); total 0.9 mm. Sensoria circular, of nearly the same size and occurring on the two specimens as follows: III, 17,20: 23,24; IV, 5,3: 6,4; V, 1,1: 2,2. Apical portions of the femora and tibiæ and all of the tarsi black, the remainder of the legs pale. Front wings 3 mm. long. Abdomen just above the cauda with a distinct short black horn about 0.04 mm. long. Cornicles black, imbricated, swollen just beyond the middle, curved slightly outward and 0.2 mm. long. Cauda dark and 0.17 mm. long.

Apterous viviparous females (Cotypes) — Ten good specimens with full color notes. Length 1.8 mm., width 1 mm. Prevailing color green. Body surface variolous as is characteristic of this genus. Antennæ short, pale at base and dark at tip, imbricated and with few hairs; lengths of the articles: I, 0.06 mm.; II, 0.04 mm.; III, 0.22 mm.; IV, 0.10 mm.; V, 0.08 mm.; VI, 0.2 mm. (base 0.09 mm., filament 0.11 mm.); total 0.7 mm. The sensorium near tip of V is noticeably large. Rostrum reaching to the 2nd coxæ. Abdomen terminating in

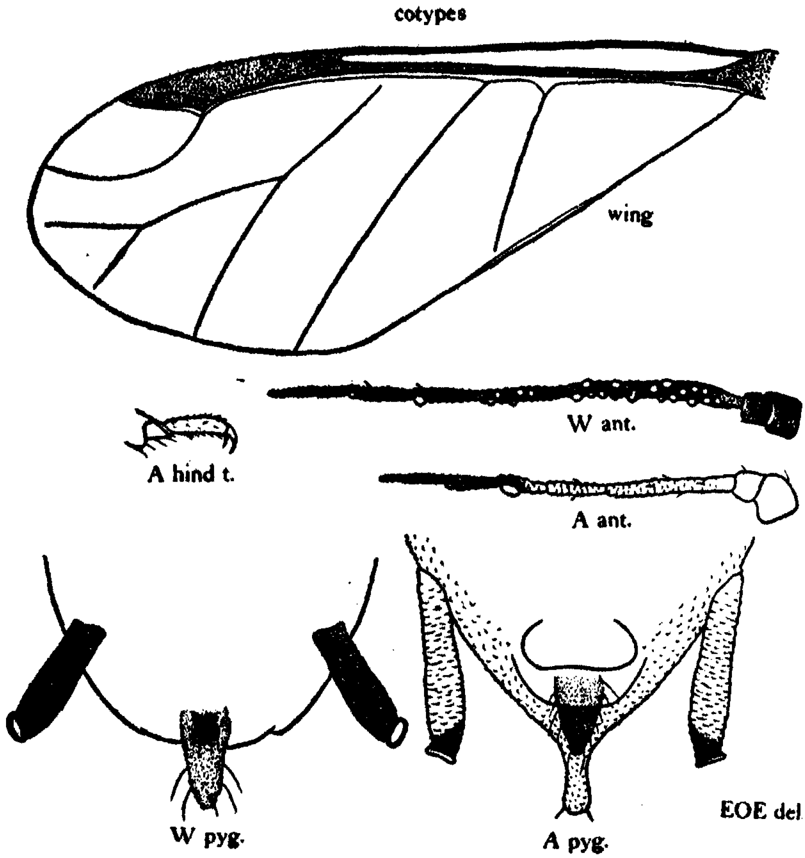

Figure 13.—*Siphocoryne bicaudata*, new species

a very long, reflexed horn extending back over the full length of the cauda, with two spines near the tip. Cornicles pale green with tips dusky, somewhat recurved, imbricated throughout and 0.3 mm. long. Cauda dusky to black, 0.13 mm. long.

Host plant—Yanagi (willow), *Salix*, species.
Locality—Tokyo.
Date of collection—May 13, 1913.
Collection number—53.

Note—This species is close to *Nipposiphum salicicola* Mats., but differs in having sensoria on articles IV and V of the antennæ of the winged forms.

Siphocoryne japonica, new species

Figure 14

Winged viviparous female (Type)—From two individuals in good condition. Length 1.2 mm., width 0.7 mm. Prevailing color blackish and green. Head dark. Antennæ black throughout, imbricated, with very few hairs; lengths of articles: I, 0.07 mm.; II, 0.05 mm.; III, 0.45 mm.; IV, 0.18 mm.; V, 0.13 mm.; VI, 0.30 mm. (base 0.12 mm., filament 0.18 mm.); total 1.18 mm. Sensoria of various sizes and numerous, distributed as follows: III (left) 43, (right) 49; IV (left) 8, (right) 8; V (left) 3, (right) 2. There is the usual number on VI. Paratype has the following number: III 27,32; IV 5,5; V 2,2. Rostrum reaching to the base of the abdomen. Thorax black. Legs pale with the apices of the tibiæ and all of the tarsi black. Front wings 3mm. long, veins brownish. Abdomen dark green with dusky or black markings on the dorsum. The abdominal posterior horn indistinct or rudimentary, dark with two apical spines. Cornicles black, somewhat recurved, imbricated, slightly swollen towards the ends, 0.28 mm. long. Cauda dusky, 0.15 mm. long.

Apterous viviparous females (Paratypes)—Two mature specimens in good condition. Length 1.7 mm., width 0.9 mm. Prevailing color dusky purplish. Bodies slender, the surface variolous. Antennæ short, pale with the apical portions dusky; lengths of the articles: I, 0.06 mm.; II, 0.05 mm.; III, 0.24 mm.; IV, 0.09 mm.; V, 0.09 mm.; VI, 0.21 mm. (base 0.09 mm., filament 0.12 mm.); total 0.74 mm. The sensoria normal. Abdominal horn short or rudimentary with two terminal hairs. Cornicles imbricated, somewhat swollen beyond the middle, recurved, pale, with the tips or apical halves dusky, 0.3 mm. long. Cauda dark, 0.12 mm. long.

Nymphs—Somewhat pale rosy in color, with dusky antennæ, legs and cornicles.

Host plant—Shirane seniku, *Angelica polymorpha* Maxim.

Locality—Nikko.

Date of collection—June 10, 1913.

Collection number—85.

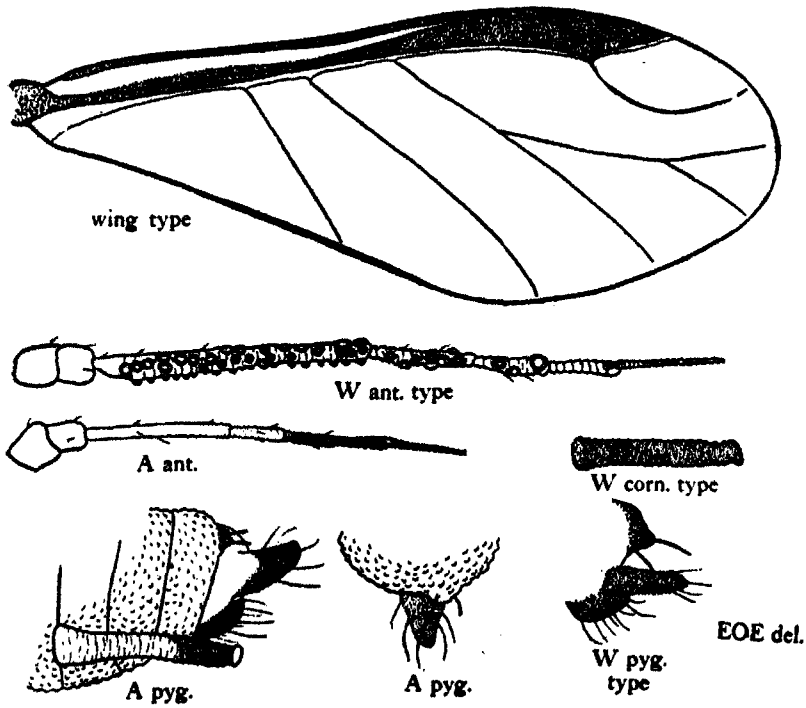

Figure 14.—*Siphocoryne japonica,* new species

REMARKS—This species is very close to *Siphocoryne bicaudata,* but has a very much smaller abdominal horn in winged and apterous forms and many more sensoria (about twice as many) on the antennæ of the winged forms.

Aphis avenæ Fab.

Two lots taken as follows:

1. Winged and apterous viviparous females on Omugi, *Hordeum vulgare* Linn. (listed as *H. sativum vulgare*), Nishigahara, Tokyo, May 28, 1913.
2. Apterous viviparous females on wheat, Nishigahara, Tokyo, May 28, 1913. Collection number 66.

Aphis brassicae Linn.

A good series of this species was collected on Aburana (Pak-choi cabbage), *Brassica chinensis* Linn., Fuknoka, June 7, 1913. Collected by M. Mori. Collection number 77.

Aphis citricola Van der Goot

1912—Mittel. Nat. Mus. 29, 2 Bieh. Jahrb. Hamb. Wissen. Aust 29, pp. 273-273, fig. 1. (Original description).

A very interesting species which agrees so well with the one described by Van der Goot from Chile, where it was collected on orange, that it is regarded as specifically identical until proven otherwise. There are minor variations in color. Good series were taken as follows:

1. On orange, Shidzuoka-Ken, May 19, 1913. Collection number 48.
2. On young shoot of citrus tree, Tokyo, Aug. 1, 1913. Collection number 97.

Aphis gossypii Glover

Figure 15

This species is apparently abundant from the number of times it was collected as will be seen from the following records:

1. On Kusagi, *Clerodendron trichotomum* Thunb., Somei, Tokyo, May 7, 1913. Collection number 2.
2. On unknown plant, Somei, Tokyo, May 10, 1913. Collection number 13.
3. On *Petasites japonicus* F. Schmidt (listed as *P. japonica* Mig.), Nishigahara, Tokyo, May 17, 1913. Collection number 44.
4. On orange, Shidzuoka-Ken, May 19, 1913. Collection number 49.
5. On Kiku, *Chrysanthemum*, species, Nishigahara, Tokyo, May 22, 1913. Collection number 52. These are very small specimens.

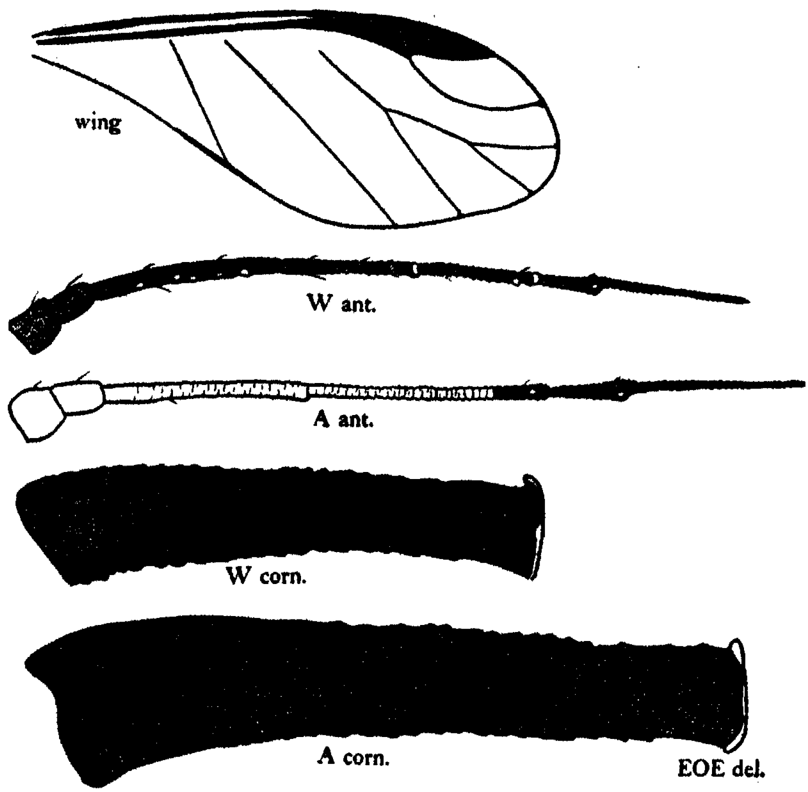

Figure 15.—*Aphis gossypii* Glover. Cornicles greatly enlarged

6. On Nasu, *Solanum melongena* Linn., and on Kiuri (cucumber), *Cucumis sativus* Linn., Tokyo, June 20, 1913. Collection number 90. Occasionally very injurious to these hosts. On some of the winged females there are one or two sensoria on article IV of the antennæ, which is not at all normal.

7. On Kiuri (cucumber), *Cucumis sativus* Linn., Nishigahara, Tokyo, June 28, 1913. Collection number 92. These are mostly typical, but cornicles are long and some have one or two sensoria on antennal article IV.

8. On potato, Nishigahara, Tokyo, June 28, 1913. Collection number 93.

9. On Sarutori-ibara, *Smilax walteri* Pursh. (listed as *S. china* Linn.), Nishigahara, Tokyo, Aug. 4, 1913. Collection number 99. These have much more hair on the antennæ than normal with article III longer and the cornicles larger. It is very likely a new species.
10. On orange, Okiku, Sgidzuoka-Ken, Oct. 5, 1913. Collection number 107.

Aphis japonica, new species

Figure 16

Winged viviparous female (Type)—Selected from five individuals. Length 1.4 mm., width (of paratype) 0.5 mm. Prevailing color dark green to black. Head black. Antennæ black throughout, imbricated and with few hairs; lengths of the articles: I, 0.06 mm.; II, 0.06 mm.; III, 0.33 mm.; IV, 0.185 mm.; V, 0.13 mm.; VI, 0.445 mm. (base 0.07 mm., fila-

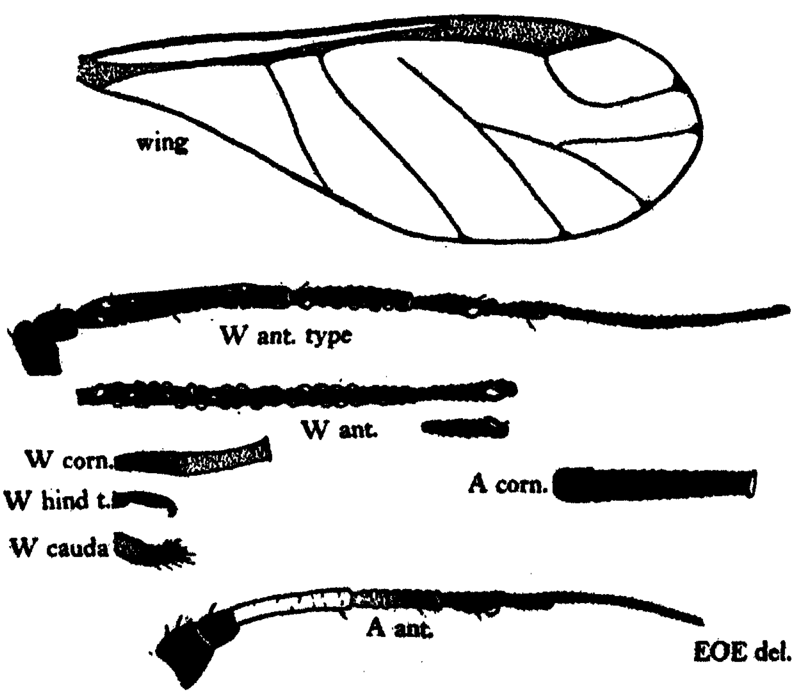

Figure 16.—*Aphis japonica*, new species

ment 0.375 mm.); total 1.21 mm. Sensoria of various sizes and distributed over III and IV in large numbers as follows: (left) III, 23; IV, 8; V, the usual normal one which is very large. The paratypes show the following variations: III, 21-28; IV, 9-12; V, 1-3. Rostrum reaching to the 2nd coxæ. Thorax shiny black. Coxæ, tarsi and apical ends of the femora and tibiæ black, the remainder of the legs pale brownish. Wing veins dusky; length of the front wings 2.1 mm. Abdomen yellowish or dark green with dark markings on the sides and dorsum. Cornicles dusky, faintly imbricated, somewhat constricted beyond the middle, slightly recurved and 0.26 mm. long. Cauda dark and 0.06 mm. long.

APTEROUS VIVIPAROUS FEMALES (Paratypes)—A large number of specimens. Length 1.27 mm., width 0.7 mm. Prevailing color dark green. Head dark green. Antennæ dark except III and the base of IV which are pale; lengths of the articles: I, 0.07 mm.; II, 0.05 mm.; III, 0.17 mm.; IV, 0.14 mm.; V, 0.095 mm.; VI, 0.30 mm. (base 0.07 mm., filament 0.23 mm.); total 0.825 mm. Thorax and abdomen dark-green. The latter with a pair of tubercles just behind the cornicles. Cornicles black, imbricated, almost straight, 0.33 mm. long. Cauda black, wide at base and 0.09 mm. long.

NYMPHS—pale green.
HOST PLANT—apple.
DATE OF COLLECTION—May 7, 1913.
COLLECTION NUMBER—4.

Aphis medicaginis Koch

Figure 17

Recorded from a number of host plants as follows:

1. On Soramame, *Vicia faba equina* Pers., Nishigahara, Tokyo, May 8, 1913. Collection number 6.
2. On Utsugi, *Deutzia scabra* Thunb., Somei, Tokyo, May 10, 1913. Collection number 14.
3. On unknown plant, Somei, Tokyo, May 10, 1913. Collection number 15.

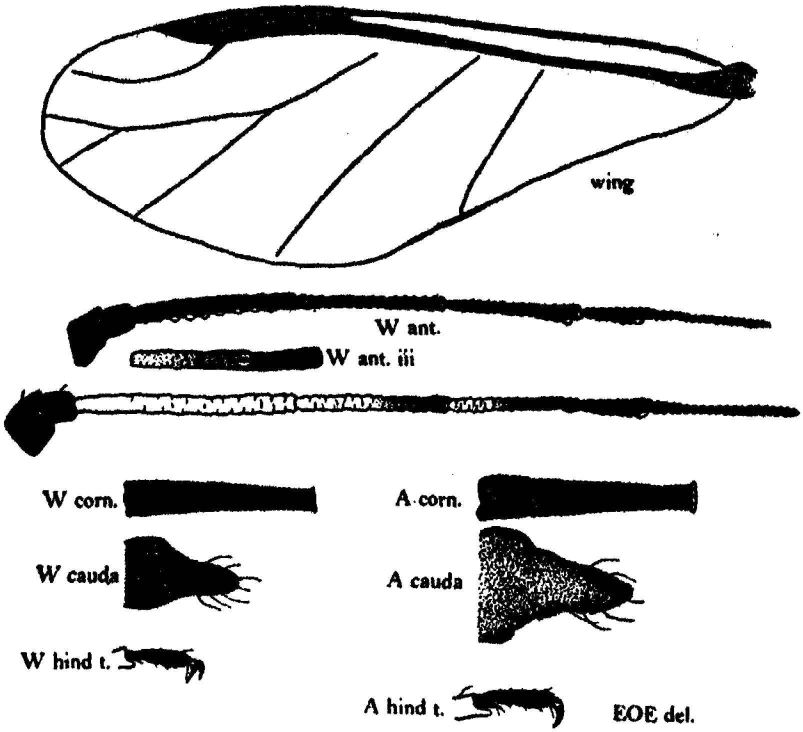

Figure 17.—*Aphis medicaginis* Koch

4. On Soramame, *Vicia faba equina* Pers., Tokyo, May 14, 1913. Collection number 33.

5. On Mukuge (shrubby althea or rose of Sharon), *Hibiscus syriacus* Linn., and on Keyaki, *Zelkova acuminata* Planch., Nishigahara, Tokyo, May 15, 1913. Collection number 38.

6. On Genge, *Astragalus sinicus* Linn., Shiga-Ken, May 23, 1913. Collection number 56.

7. On Waremokau, *Poterium officinale* A. Gray (listed as *Sanguisorba officinalis* Linn.), Nikko, June 10, 1913. Collection number 87. Only apterous viviparous females present.

Aphis pomi DeGeer

Collected in two lots as follows:

1. On Bake (Japan quince or Japonica), *Chænomeles japonica* Lindl., (listed as *Cydonia japonica* Pers.), Nakano, Tokyo, May 25, 1913. Collection number 60.
2. On apple and Japanese pear, Tokyo, June 2, 1913. Collection number 69.

Aphis rumicis Linn.

The material taken checks up with this species very well. It was collected as follows:

1. On Gishi-gishi, *Rumex crispus* Linn. (listed as *R. japonicus* Meisn.), Nishigahara, Tokyo, May 14, 1913. Collection number 35. One imperfect winged individual and apterous females in this lot.
2. On Gishi-gishi, Tokyo, May 26, 1913. Collection number 61.

Aphis siphonella, new species

Figure 18

WINGED VIVIPAROUS FEMALE (Type)—Selected from six specimens. Length 1.2 mm., width 0.6 mm. Head dark. Antennæ black throughout, imbricated and with few hairs; lengths of articles: I, 0.05 mm.; II, 0.05 mm.; III, 0.26 mm.; IV, 0.23 mm.; V, 0.26 mm.; VI, 0.42 mm. (base 0.12 mm., filament 0.30 mm.); total 1.27 mm. Sensoria numerous on III, a few on IV, and normal on V and VI. On the left antenna (right member missing) there are on III, 20; on IV, 4. The single normal one on V is quite a distance from the tip. On the paratypes the number varies as follows: III, 7-20; IV, 0-1. Rostrum (paratype) reaching to the 2nd coxæ. Prothorax dark green, the remainder of the thorax black; distinct lateral prothoracic tubercles evident on some of the paratypes as are also several pairs of marginal abdominal tubercles. Coxæ, tarsi and the apices of the femora and tibiæ black, the

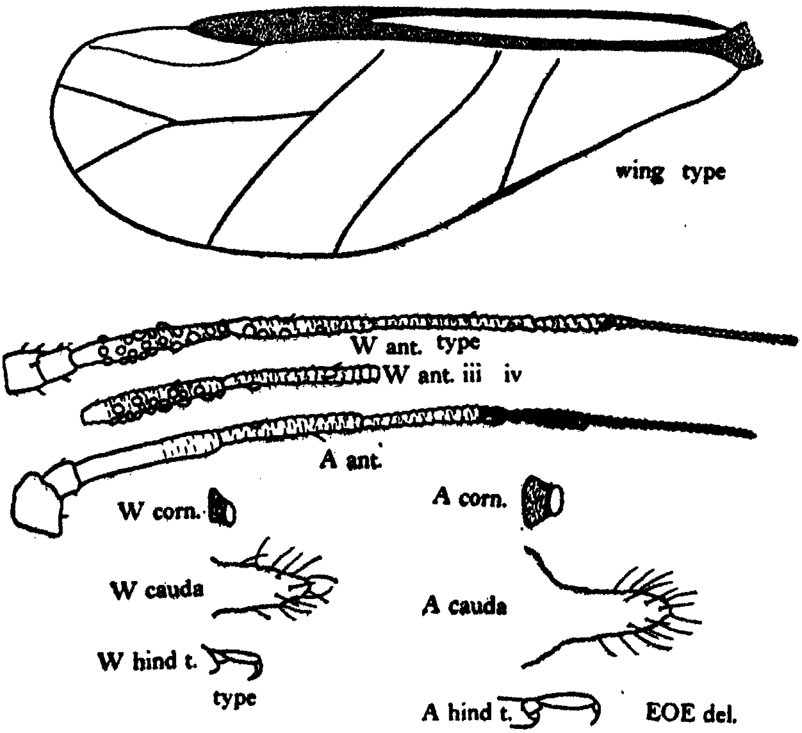

Figure 18.—*Aphis siphonella*, new species

remainder of the legs pale. Primary wings 2.7 mm. long. Cornicles very short, black, 0.025 mm. long; the cauda dark, 0.16 mm. long.

Apterous viviparous females (Paratypes)—Ten specimens. Length 1.4 mm., width 1 mm. Prevailing color dark brown, the body being slightly covered with a white pulverulence. Antennæ with articles I and II dusky; III, IV and most of V pale, and the tip of V and all of VI black; lengths of the articles: I, 0.07 mm.; II, 0.05 mm.; III, 0.24 mm.; IV, 0.22 mm.; V, 0.24 mm.; VI, 0.39 mm. (base 0.12 mm., filament 0.27 mm.); total 1.21 mm. There is a pair of short but distinct lateral prothoracic tubercles. Abdomen dark brown with black markings on the dorsum and with four or more

pairs of lateral tubercles. Cornicles black, imbricated and very short, 0.05 mm. long. Cauda black, 0.25 mm. long.

NYMPHS—pale with dark wing pads.
HOST PLANT—Japanese pear.
LOCALITY—Ōmori, Tokyo.
DATE OF COLLECTION—May 12, 1913.
COLLECTION NUMBER—29.
REMARKS—Named from its very short cornicles.

Aphis somei, new species

Figure 19

WINGED VIVIPAROUS FEMALE (Type)—From a large series. Length 1.6 mm., width 0.7 mm. Prevailing color dark olive green and black. Antennæ black throughout, imbricated, well clothed with conspicuous and quite long hairs; lengths of the articles: I, 0.06 mm.; II, 0.06 mm.; III, 0.31 mm.; IV, 0.25 mm.; V, 0.27 mm.; VI, 0.43 mm. (base 0.12 mm., filament 0.31 mm.); total 1.38 mm. Sensoria on III (right) 8; IV (right) 2; (left) 3. On the paratypes the number varies as follows: III, 8-14; IV, 1-5; V and VI have the normal ones. Rostrum reaching nearly to the 3rd coxæ. Thorax shiny black with large blunt prothoracic tubercles on the sides. Front wings 3.2 mm. long. Abdomen dark green with black transverse markings on the dorsum. Cornicles very short, black, imbricated, slightly swollen at the base or middle with flaring mouth, length 0.12 mm. Cauda dark, 0.14 mm. long.

APTEROUS VIVIPAROUS FEMALES (Paratypes)—A large series of specimens. Average length 1.9 mm., width 1.3 mm. Prevailing color brown or purplish, often slightly covered with whitish powder. Antennæ dark with the bases of III, IV and sometimes V pale; lengths of the articles: I, 0.09 mm.; II, 0.07 mm.; III, 0.38 mm.; IV, 0.26 mm.; V, 0.25 mm.; VI, 0.42 mm. (base 0.13 mm., filament 0.29 mm.); total 1.47 mm. Lateral prothoracic tubercles present and at least one pair of tubercles on the abdomen. Cornicles short, usually widest at base with flaring mouth, imbricated, 1.51 mm. long. Cauda greenish to dark, wide at base, pointed, 0.09 mm. long.

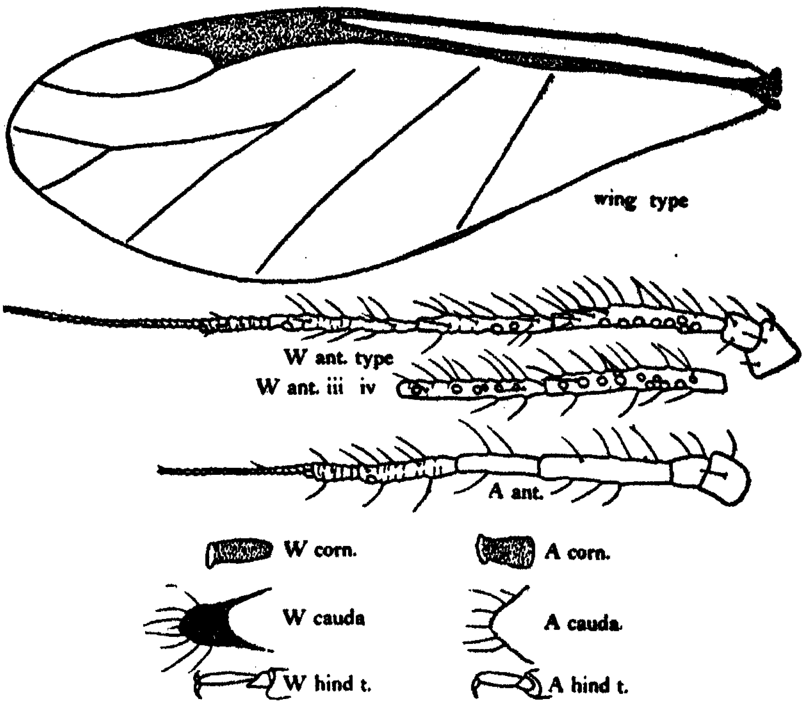

Figure 19.—*Aphis somei*, new species

Host plants, localities, etc.—This species was taken as follows:

1. On Nurude, *Rhus javanica* Linn. (listed as *R. semialata* Murr.), Nishigahara, Tokyo, May 7, 1913. Collection number 3.
2. On Yabudomari, *Viburnum tomentosum* Thunb., Somei, Tokyo, May 9, 1913. Collection number 11.
3. On apple, Nishigahara, Tokyo, May 11, 1913. Collection number 20.
4. On orange, Nishigahara, Tokyo, May 31, 1913. Collection number 68.
5. On Japanese pear, Tokyo, June 2, 1913. Collection number 70.

Aphis spinosula, new species

Figure 20

WINGED VIVIPAROUS FEMALE (Type)—From four individuals in rather poor condition. Length 1.1 mm., width 0.45 mm. Prevailing colors green and black. Head shiny black. Antennæ black except the base of III which is slightly pale; lengths of articles: I, 0.04 mm.; II, 0.05 mm.; III, 0.34 mm.; IV, 0.17 mm.; V, 0.13 mm.; VI, 0.44 mm. (base 0.10 mm., filament 0.34 mm.); total 1.17 mm. Sensoria numerous; 25 on III (right), 6 on IV, 2 on V. Paratypes have from 25-27 on III, 9-11 on IV and 1-3 on V. Rostrum extending to the 3rd coxæ. Thorax shiny black. Legs pale green with the distal ends of the femora and tibiæ and the entire tarsi black.

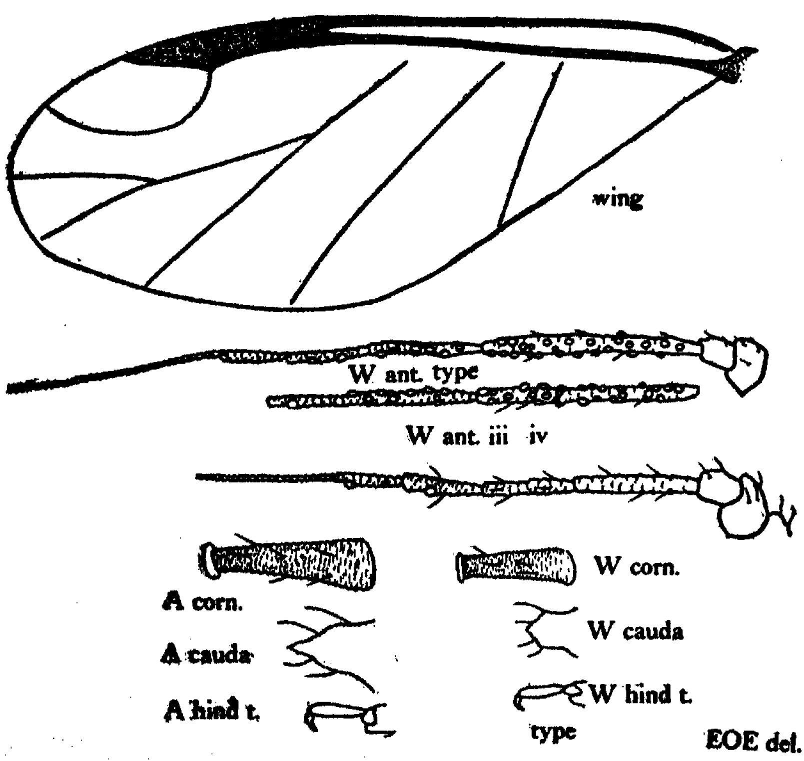

Figure 20.—*Aphis spinosula*, new species

Front wings 2.7 mm. long. Abdomen pale-green with indistinct rough wart-like marginal tubercles. Cornicles dusky, straight, widest at the base, slightly flaring at the mouth, imbricated with several spine-like hairs and 0.18 mm. long. Cauda pale green, short, bluntly pointed, 0.07 mm. long.

APTEROUS VIVIPAROUS FEMALES (Paratypes)—A good series of specimens. Length 1.5 mm., width 1.1 mm. Prevailing colors pale and dark green. Antennæ dark with the base of III pale, imbricated; lengths of articles: I, 0.05 mm.; II, 0.06 mm.; III, 0.19 mm.; IV, 0.14 mm.; V, 0.12 mm.; VI, 0.32 mm. (base 0.09 mm., filament 0.23 mm.); total 0.88 mm. Prothoracic tubercles in the form of large rough basal projections. Abdomen pale-green, with short, wart-like marginal tubercles. Cornicles black, imbricated, same shape as in the winged form, and with several spines as shown in the accompanying drawing; length 0.25 mm. Cauda dark, widest at base, pointed, 0.13 mm. long.

NYMPHS—pale-green with dusky antennæ and cornicles.

HOST PLANT—Cherry.

LOCALITY—Nishigahara, Tokyo.

DATE OF COLLECTION—May 10, 1913.

COLLECTION NUMBER—16.

REMARKS—Named from the spines of the cornicles.

Aphis thalictrii, new species

Figure 21

WINGED VIVIPAROUS FEMALE (Type)—Selected from two good specimens. Length 1.2 mm. Only side view shown so no measurement of width possible. Prevailing colors yellow and black. Head black. Antennæ black throughout, imbricated, with article III exceptionally long; lengths of articles: I, 0.06 mm.; II, 0.05 mm.; III, 0.58 mm.; IV, 0.13 mm.; V, 0.13 mm.; VI, 0.25 mm. (base 0.10 mm., filament 0.15 mm.); total 1.2 mm. Article III with many sensoria; 56 on left member and 64 on right; the paratype shows 44 and 52; remaining articles with the usual number. Rostrum reaching nearly to the 2nd coxæ. Prothorax dusky yellow, remaining thoracic

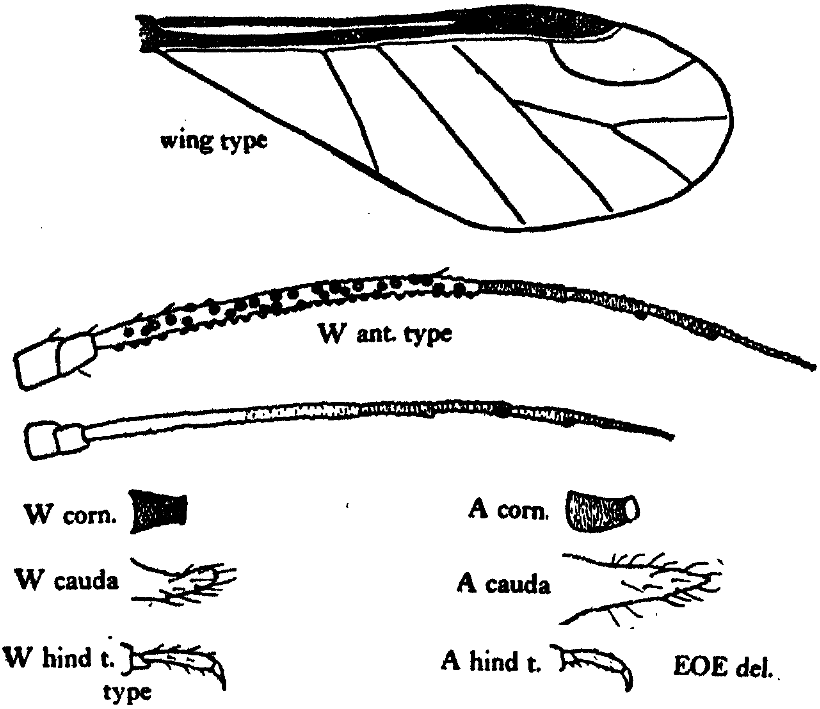

Figure 21.—*Aphis thalictrii*, new species

segments black. Legs pale with the tips of the femora, the tibiæ and the entire tarsi black. Front wings 2 mm. long. Abdomen lemon-yellow with dusky dorsal markings. Cornicles pale-yellow, finely imbricated, widest at base, 0.07 mm. long. Cauda pale-yellow, 0.12 mm. long.

APTEROUS VIVIPAROUS FEMALES (Paratypes)—Three or four good specimens. Length 1.1 mm., width 0.65 mm. Prevailing color pale lemon-yellow. Antennæ pale throughout and finely imbricated; lengths of articles: I, 0.03 mm.; II, 0.04 mm.; III, 0.41 mm.; IV, 0.10 mm.; V, 0.12 mm.; VI, 0.25 mm. (base 0.10 mm., filament 0.15 mm.); total 0.95 mm. Article III very long as will be seen from the above. Rostrum reaching to the 2nd coxæ. Cornicles pale, short, finely imbricated, widest at the base and gradually tapering towards the mouth, 0.08 mm. long. Cauda pale, noticeably long, being 0.21 mm.

Nymphs—Pale-yellow.
Host plant—Aki-Karamatsu, *Thalictrum minus* Linn.
Locality—Nishigahara, Tokyo.
Date of collection—August 4, 1913.
Collection number—101.

Aphis, species

But two winged viviparous females with antennæ missing were received. The color is given as bright yellow with dark head, antennæ, thorax, cornicles and portions of the legs. Cornicles and cauda are short, the latter broad. This species was taken from pseudogalls made on the upper surface near the midribs of cherry leaves, Nishigahara, Tokyo, May 19, 1913. Collection number 46.

Aphis, species

This species is represented by a few apterous viviparous females, described as green in color with pale green cornicles having black tips. It was collected on strawberry, probably at Nishigahara, Tokyo (? locality omitted), May 13, 1913. Collection number 31.

Toxoptera aurantii Fonsc.[3]

This species was collected on Skikimi, *Illicium anisatum* Linn., at Nishigahara, Tokyo, May 17, 1913. Collection number 45.

Toxoptera piricola Mats.

Figure 22

Winged viviparous female—From two good specimens. Length 1.6 mm., width 0.65 mm. Prevailing colors black and dark green. Head black. Antennæ black with articles I, II and the extreme base of III dusky or pale, imbricated, with few hairs and many sensoria; lengths of the articles: I, 0.05 mm.; II, 0.07 mm.; III, 0.41 mm.; IV, 0.27 mm.; V, 0.21 mm.; VI,

[3] *T. aurantiæ* Koch is a synonym of this species. See W. P. Phillips and J. J. Davis, Tech. Ser. no. 25, pt. I, Bur. Ent. U. S. Dept. Agric., p. 8, May 4, 1912.

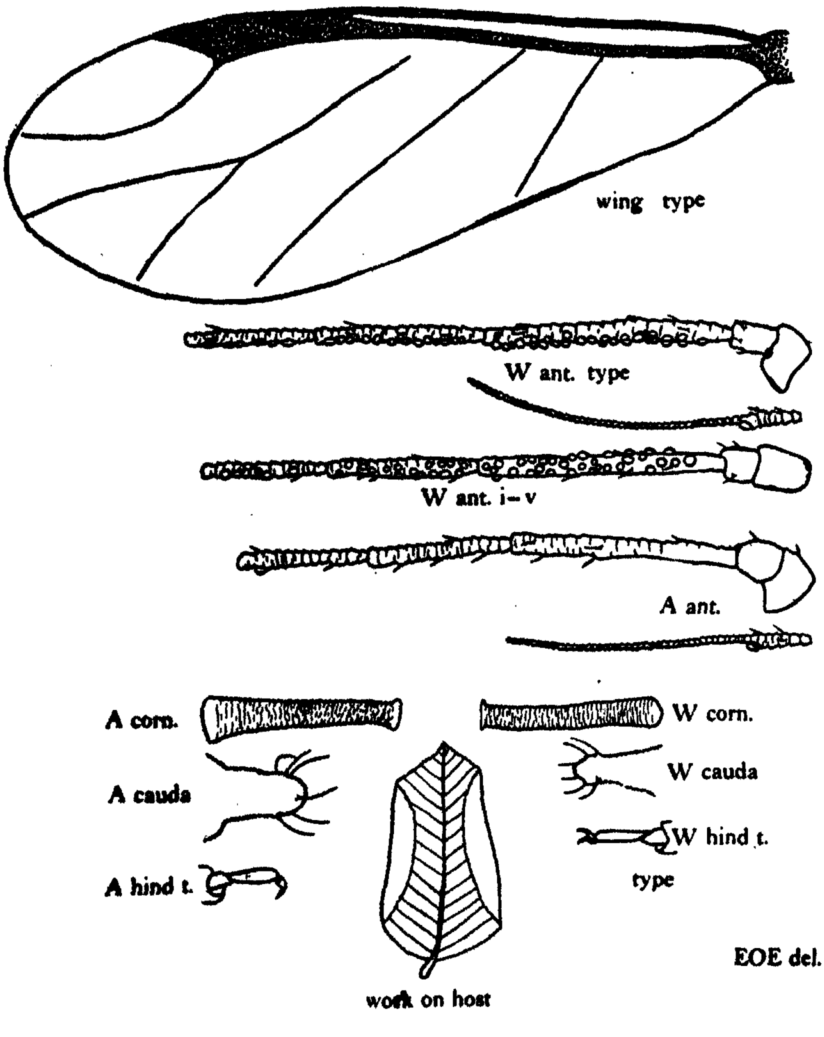

Figure 22.—*Toxoptera piricola* Mats.

0.56 mm. (base 0.10 mm., filament 0.46 mm.); total 1.57 mm. Sensoria circular of various sizes and distributed as follows: III (left) 29, (right) 26; IV (left) 14, (right) 15; V (left) 5, (right) 6. One individual shows the following: III (left) 32, (right) 24; IV (left) 16, (right) 16; V (left) 4, (right) 5 (some of these are difficult to make out). Rostrum reaching

nearly to the 3rd coxæ. Thorax black. Primary wings 3 mm. long. Legs pale with the distal ends of the femora and tibiæ and all of the tarsi black. Abdomen green with dark lateral and dorsal spots and with four pairs of marginal tubercles visible. Cornicles black, faintly imbricated, slightly widest at the base but almost cylindrical, somewhat incurved, 0.3 mm. long. Cauda black, 0.15 mm. long.

Apterous viviparous females—Fifteen good specimens. Average length 1.35 mm., width 0.85 mm. Prevailing color green. Antennæ dark except I, II and the base of III which are pale; lengths of articles: I, 0.05 mm.; II, 0.07 mm.; III, 0.32 mm.; IV, 0.23 mm.; V, 0.21 mm.; VI, 0.5 mm. (base 0.1 mm., filament 0.4 mm.); total 1.38 mm. Rostrum reaching midway between the 2nd and 3rd coxæ. Cornicles pale dusky with darker tips, faintly imbricated, 0.33 mm. long. Cauda color of body, 0.17 mm. long.

Host plant—Forms pseudogalls on the edges of the leaves of the Japanese pear.

Locality—Ōmori, Tokyo.

Date of collection—May 12, 1913.

Collection number—28.

Chaitophorus japonica, new species

Figure 23

Winged viviparous female (Type)—Selected from three good specimens. Length 1.4 mm., width (of paratype) 0.6 mm. across the thorax. Prevailing color shiny black. Body covered with long hairs. Head black. Antennæ dark with all of III and the bases of IV and V pale, with numerous conspicuous long hairs along the upper margin; lengths of articles: I, 0.05 mm.; II, 0.04 mm.; III, 0.43 mm.; IV, 0.19 mm.; V, 0.19 mm.; VI, 0.33 mm. (base 0.10 mm., filament 0.23 mm.); total 1.23 mm. Sensoria large, circular and distributed along the full length of III, there being 10 on the left member (right missing). Paratypes show a variation of 8, 6, 14 on III; the other articles have the usual number. Rostrum extending slightly beyond the 2nd coxæ. Front wings 2.4 mm. long.

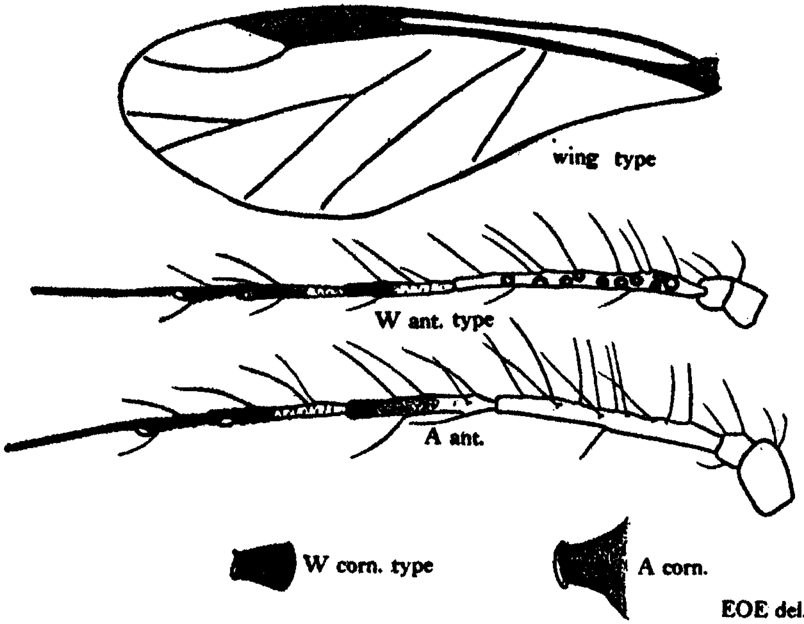

Figure 23.—*Chaitophorus japonica*, new species

Tarsi and apices of the tibiæ and femora black, the remainder of the legs pale. Abdomen dark with yellow patches around the cornicles. Cornicles dark, imbricated, widest at the base, 0.1 mm. long. Cauda dark, inconspicuous.

Apterous viviparous females (Paratypes)—Two rather poor specimens. Length 1.3 mm., width 0.9 mm. Prevailing color shiny black. Body covered with long hairs. Antennæ about the same color as in the winged form and as hairy; lengths of articles: I, 0.10 mm.; II, 0.05 mm.; III, 0.4 mm.; IV, 0.25 mm.; V, 0.24 mm.; VI, 0.33 mm. (base 0.12 mm., filament 0.21 mm.); total 1.37 mm. Cornicles dark, imbricated, somewhat constricted near the middle, 0.13 mm. long and 0.16 mm. diameter at base.

Host plant—Enkō-Kaede, *Acer pictum* Thunb.
Locality—Nikko.
Date of collection—June 9, 1913.
Collection number—86.

Chaitophorus salijaponica, new species

Figure 24

WINGED VIVIPAROUS FEMALE (Type)—From three good specimens. Length 1.2 mm., width 0.5 mm. Prevailing color dark-green to blackish. Head shiny black. Antennæ dusky, slightly darker at the tips of the articles, imbricated and with few long hairs on front margin; lengths of the articles: I, 0.05 mm.; II, 0.04 mm.; III, 0.25 mm.; IV, 0.13 mm.; V, 0.14 mm.; VI, 0.32 mm. (base 0.11 mm., filament 0.21 mm.); total 0.91 mm. Sensoria circular and distributed as follows: III (left) 8, (right) 11; IV (left) 1, (right) 3; V (left) 2, (right) 1. Paratypes show the following: III, 8-10; IV, 2-4; V, 1-4. Rostrum reaching nearly to the 2nd coxæ. Thorax shiny black. Front wings narrow, 2 mm. long. Legs dusky with black tarsi. Abdomen dark green with darker dorsal and lateral

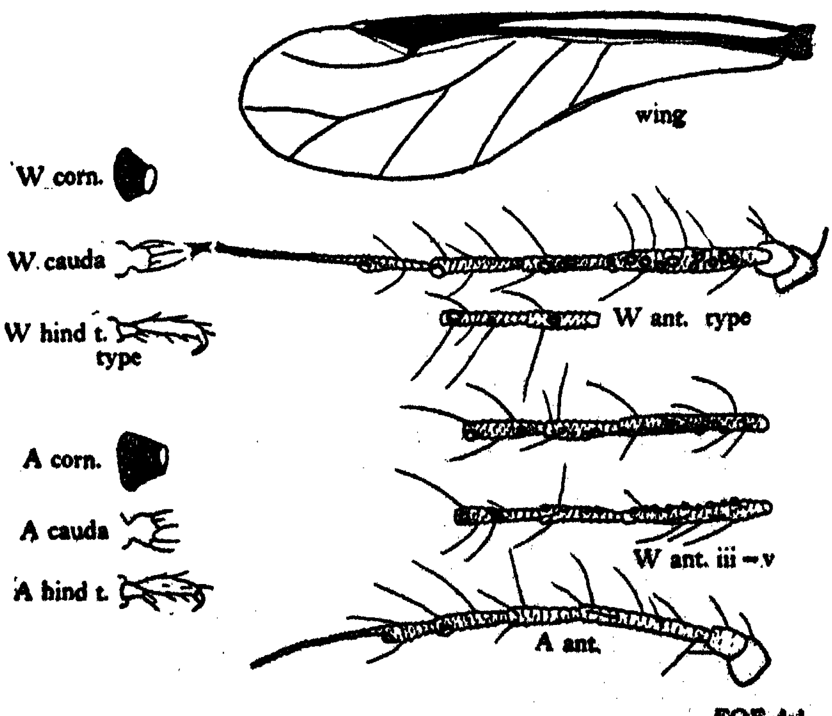

Figure 24.—*Chaitophorus salijaponicus*, new species

markings. Cornicles imbricated or faintly reticulate, short, wide at the base, 0.05 mm. long and 0.07 mm. diameter at the base. Cauda distinctly knobbed, small, 0.05 mm. long.

APTEROUS VIVIPAROUS FEMALES (Paratypes)—Three or four good specimens. Length averages 1 mm., width 0.6 mm. Prevailing color dark. Body covered with long hairs. Antennæ pale with the apical half dusky to black, imbricated, with few long hairs; lengths of the articles: I, 0.04 mm.; II, 0.05 mm.; III, 0.20 mm.; IV, 0.11 mm.; V, 0.12 mm.; VI, 0.28 mm. (base 0.08 mm., filament 0.20 mm.); total 0.8 mm. Rostrum extending slightly beyond the 2nd coxæ. Cornicles short, finely imbricated or reticulate, 0.06 mm. long and 0.09 mm. diameter at the base. Cauda dark, knobbed, 0.06 mm. long.

NYMPHS—Dark with pale thorax.

HOST PLANT—Koriyanagi, *Salix multinervis* F. & Sav.

LOCALITY—Nishigahara, Tokyo.

DATE OF COLLECTION—May 14, 1913.

COLLECTION NUMBER—36.

Note—Close to *C. salicicolus* Mats., but differs in antennal structure, especially the relative lengths of base and spur of article VI.

Calaphis magnoliæ, new species

Figure 25

WINGED VIVIPAROUS FEMALE (Type)—Selected from seventeen good specimens. Length 1.4 mm., width 0.5 mm. This beautiful species is pale straw-yellow with black markings on the body and wings. The hairs on the head and thorax are quite long, somewhat shorter on the abdomen. Antennæ arising from inconspicuous frontal tubercles, very long, pale or transparently white with conspicuous black areas near the middle and apex of article III and with the extreme bases and apices of IV and V black, and all of VI black or dusky except the base; lengths of the articles: I, 0.09 mm.; II, 0.05 mm.; III, 0.81 mm.; IV, 0.58 mm.; V, 0.52 mm.; VI, 1.14 mm. (base 0.18 mm., filament 0.96 mm.); total 3.19 mm. Sensoria on III circular or oval, arranged in a row and mostly

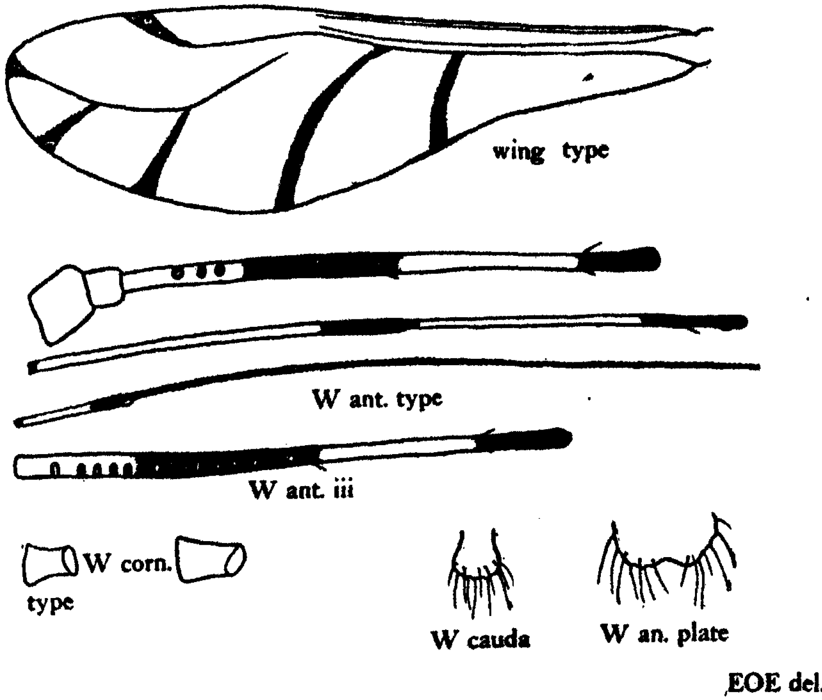

Figure 25.—*Calaphis magnoliæ*, new species

confined to the dark area near the middle with 3 or 4 in the pale basal region; there are 10 on each member. On the paratypes the number varies from 10 to 14 with a majority having 11 or 12. The usual number occurs on V and VI. Rostrum short, extending slightly beyond the first coxæ. Legs pale with the extreme apex of the femora dusky above; the bases of the tibiæ conspicuously black with the adjacent region pale yellow, and the apical half and the tarsi dusky. Front wings conspicuously marked with black as shown in the accompanying drawing; long and narrow, measuring in length 2.5 mm.; stigma very pale with black tip, the radial sector vein wanting. Hind wings pale throughout. Abdomen apparently with five pairs of inconspicuous tubercles which are very difficult to distinguish as they are small and concolorous with the body. Cornicles pale, slightly constricted in the middle and widest at the base, 0.06

mm. long (paratype 0.08 mm. long). Cauda pale and distinctly knobbed. Anal plate pale with small median constriction or incision.

Nymphs—Pale-yellow and covered with numerous long capitate hairs or spines.

Host plant—On the leaves of Kobushi, *Magnolia kobus* Thunb.

Locality—Akabane, near Tokyo.

Date of collection—August 1, 1913.

Collection number—96.

Euceraphis japonica, new species

Figure 26

Winged viviparous female (Type)—A single fine specimen and several nearly mature nymphs. Length 2.1 mm., width 0.7 mm. Prevailing color dark reddish brown with black dorsal markings. Body thickly beset with rather long fine hairs. Antennæ dark throughout with many long fine hairs; lengths of articles: I, 0.11 mm.; II, 0.12 mm.; III, 1.10 mm.; IV, 0.6 mm.; V, 0.46 mm.; VI, 0.35 mm. (base 0.20 mm., filament 0.15 mm.); total 2.74 mm. All of article III except the extreme ends thickly covered with many transversely oval sensoria as shown in the accompanying drawing. There are the usual number on V and VI. Rostrum (of nymph) reaching nearly to the 2nd coxæ. Front wings narrow, 4.2 mm. long. Tarsi, apices of the tibiæ and the femora black, the remainder of the legs pale brown. Abdomen dark reddish brown with black dorsal markings. Cornicles black, shorter than wide, those on the type indistinguishable because of the opaque body. On a nearly mature nymph they are 0.03 mm. long and 0.04 mm. in diameter at the base. Cauda black and rounded. Anal plate black, with a very small middle constriction.

Apterous viviparous female (Paratype)—A single good specimen. Length 2.3 mm., width 1 mm. Color about the same as in the winged form. Body hairy. Antennæ dark, hairy; lengths of the articles: I, 0.13 mm.; II, 0.09 mm.; III,

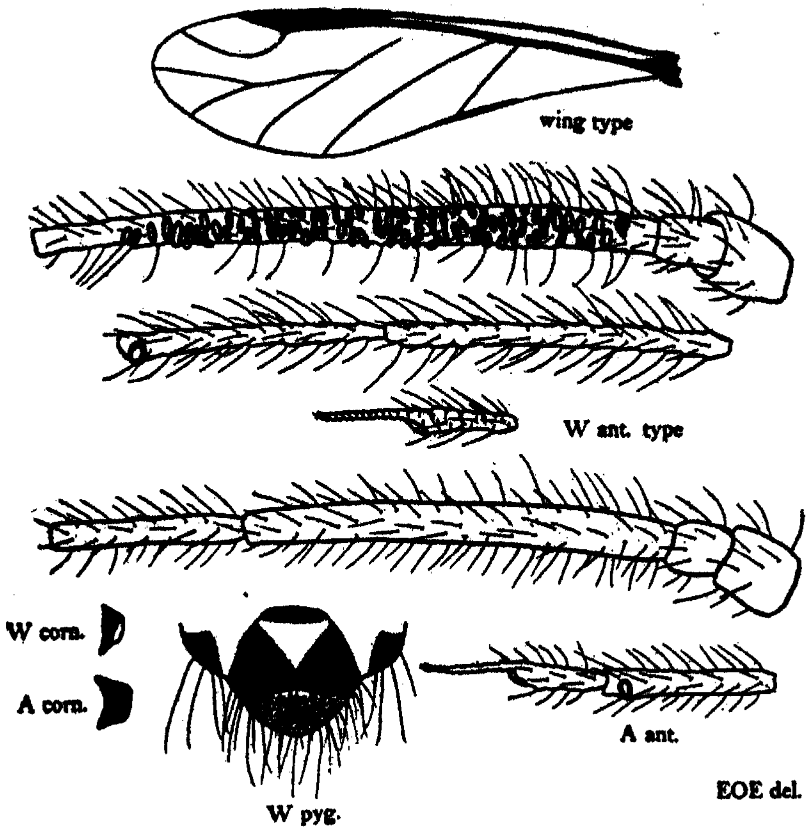

Figure 26.—*Euceraphis japonica*, new species. Wing much reduced from scale.

0.75 mm.; IV, 0.34 mm.; V, 0.29 mm.; VI, 0.31 mm. (base 0.17 mm., filament 0.14 mm.); total 1.91 mm. Rostrum reaching to the 2nd coxæ. Cornicles black, short, 0.04 mm. long and 0.08 mm. diameter at the base. Cauda black, rounded or nearly truncate.

Nymphs—Only a little lighter in color than the adults.

Host plant—Yama hannoki, *Alnus indica glauca* Ait.

Locality—Nikko.

Date of collection—June 11, 1913.

Collection number—84.

Myzocallis capitata, new species

Figure 27

WINGED VIVIPAROUS FEMALES (Cotypes)—There are fourteen specimens of winged females but none perfect enough to be designated as type. Length 1.8 mm., width 0.5 mm. Prevailing color pale yellowish green. Body covered with large and small spines. Head whitish with a number of long stiff spines arising from short tubercles. Antennæ pale green with the apices of III, IV and V and the middle and tip of VI black; articles I and II each with one, and III with 4 to 6 large, curved, knobbed, black spines which are very conspicuous; lengths of articles: I, 0.05 mm.; II, 0.05 mm.; III, 0.50 mm.; IV, 0.30 mm.; V, 0.27 mm.; VI, 0.43 mm. (base 0.16 mm., filament 0.27 mm.); total 1.6 mm. Sensoria on III, large, circular, in a row, confined to the basal half and from two to six in number, the majority having four.

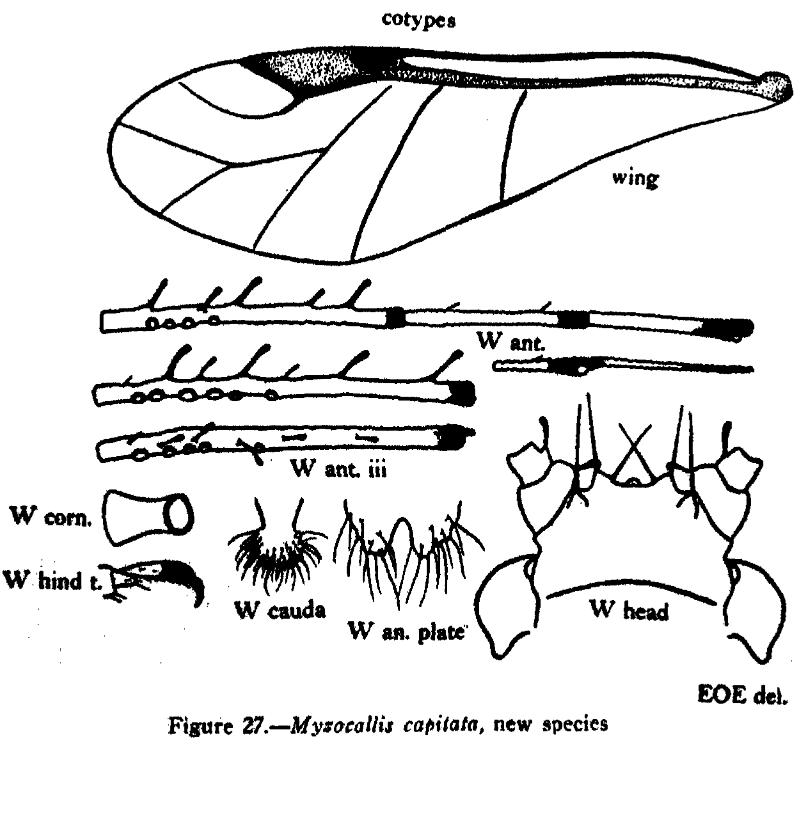

Figure 27.—*Myzocallis capitata*, new species

Rostrum reaching to the 2nd coxæ. Prothorax with two pairs of large dorsal finger-like tubercles and one pair of large lateral ones, all supporting a number of spines; mesothorax with many small tubercles supporting each a spine, those on the metathorax, if present, very obscure. Front wings 2.6 mm. long with venation and markings as shown in the accompanying drawing. Legs pale green with the tips of the tarsi dusky or black. Abdomen with three pairs of large finger-like tubercles on the dorsum near the base, two pairs of small ones just behind these and three or four pairs of large somewhat truncate ones along the sides. All of these tubercles are pale dusky and each has a number of spines. Cornicles pale, widest at base, somewhat constricted in the middle and 0.1 mm. long. Cauda green, distinctly knobbed, with quite a long stipe, 0.1 mm. in length. Anal plate pale and deeply constricted in the middle.

NYMPHS—Pale-yellow and green with the bodies covered with long capitate hairs.

HOST PLANT—On the underside of the leaves of Kunugi, *Quercus serrata* Thunb.

LOCALITY—Tokyo.

DATE OF COLLECTION—May 26, 1913.

COLLECTION NUMBER—63.

REMARKS—Named from the conspicuous knobbed or capitate hairs on the antennæ.

Myzocallis macrotuberculata, new species

Figure 28

WINGED VIVIPAROUS FEMALE (Type)—Selected from thirteen good specimens. Length 1.5 mm., width 0.6 mm. Prevailing color green with dark abdominal tubercles. Head with a number of long stout spines arising from small, somewhat dusky tubercles. Antennæ pale-green with the apical portions of III-VI dusky or black, with many long hairs; lengths of the articles: I, 0.07 mm.; II, 0.05 mm.; III, 0.42 mm.; IV, 0.30 mm.; V, 0.21 mm.; VI, 0.25 mm. (base 0.13 mm., filament 0.12 mm.); total 1.30 mm. Sensoria on III circular, in a row the full length of the article, 9 on left member and 8 on the right. Paratypes show a variation of from 7 to 11, the majority hav-

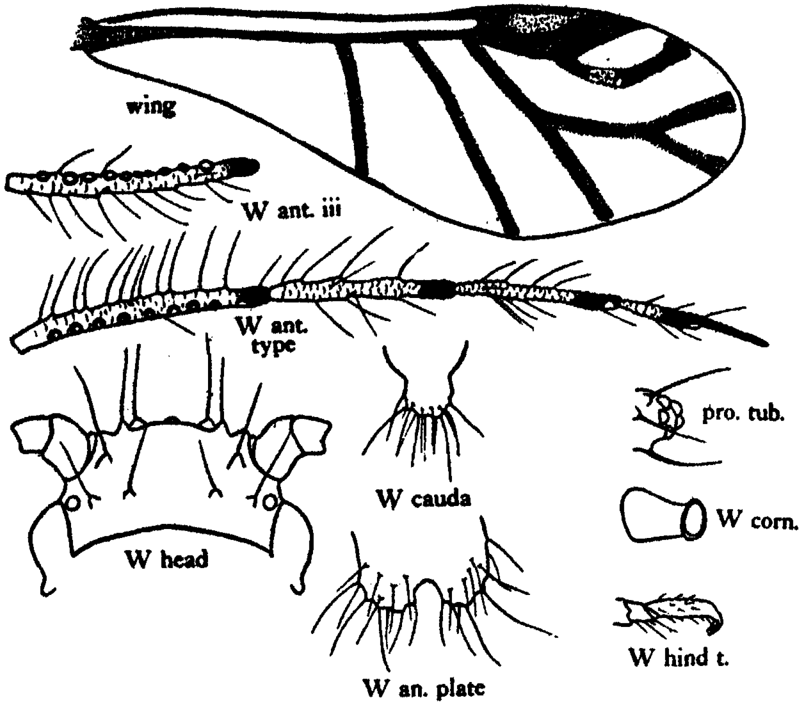

Figure 28.—*Myzocallis macrotuberculata*, new species

ing 8. Rostrum reaching to base of abdomen; prothorax with three pairs of large, dusky finger-like tubercles, two pairs on the dorsum and a lateral pair with several small smooth hemispherical projections at the top, which appear not unlike ocelli, the lateral pair of tubercles largest. On the mesothorax are two pairs of tubercles, the first pair small and the hind pair large, finger-like and located near the base of the wings. There appears to be a pair of small tubercles on the metathorax but they are not plain on the mounted specimens. From the large tubercles arise several spines and from the small ones but a single one. Coxæ and trochanters green, the remainder of the legs dusky. Wings rather slender, the veins of both pairs with clouded borders. The front wings have venation as shown in the illustration and are 2.5 mm. long. Abdomen pale green with dark tubercles as follows: three pair of large black finger-like ones on the middle base of the dorsum, the first pair the

smallest and the last pair largest; five pairs of large truncate, mostly faintly bilobed yellow or pale dusky ones, on the sides, many of which are as large as the cornicles. From each of these tubercles arise a number of hairs or spines. Cornicles pale green, widest at the base, somewhat constricted near the middle; the length, 0.10 mm., greater than the width. Cauda knobbed with only a slight basal constriction, pale green, 0.10 mm. long. Anal plate distinctly bilobed.

Nymphs—Pale green, the bodies thickly beset with long hairs which are not knobbed at the tips.

Host plant—On the underside of the leaves of Kashiwa, *Quercus dentata* Thunb.

Locality—Tokyo? (not given).

Date of collection—May 19, 1913.

Collection number—47.

Remarks—The species is named from the large tubercles on the dorsum.

Myzocallis kuricola (Mats.)
(**Nippocallis kuricola** Mats.)

Figure 29

Winged viviparous female—Thirty-two good specimens. Length 1.2 mm., width 0.55 mm. Prevailing color pale green, the body covered with a whitish powder. Head pale green to amber with several pairs of small tubercles from each of which arises a single long straight spine. Antennæ pale, furnished with a few long hairs, with the articles I, II and the extreme base of III and the apices of III-VI dusky or brownish; lengths of the articles: I, 0.05 mm.; II, 0.06 mm.; III, 0.39 mm.; IV, 0.18 mm.; V, 0.17 mm.; VI, 0.18 mm. (base 0.09 mm., filament 0.09 mm.); total 1.03 mm. Sensoria large, circular and in a row. On III there are 6 on each member, the paratypes showing a variation of from 5 to 8; articles V and VI have the usual ones. Rostrum reaching to the second coxæ. Tubercles on the thorax small, with single spines arising from each. Legs pale green with the distal ends of the tibiæ and the tarsi faintly dusky. The veins of the wings are heavily clouded, the borders being specially wide in the front wings as shown in the

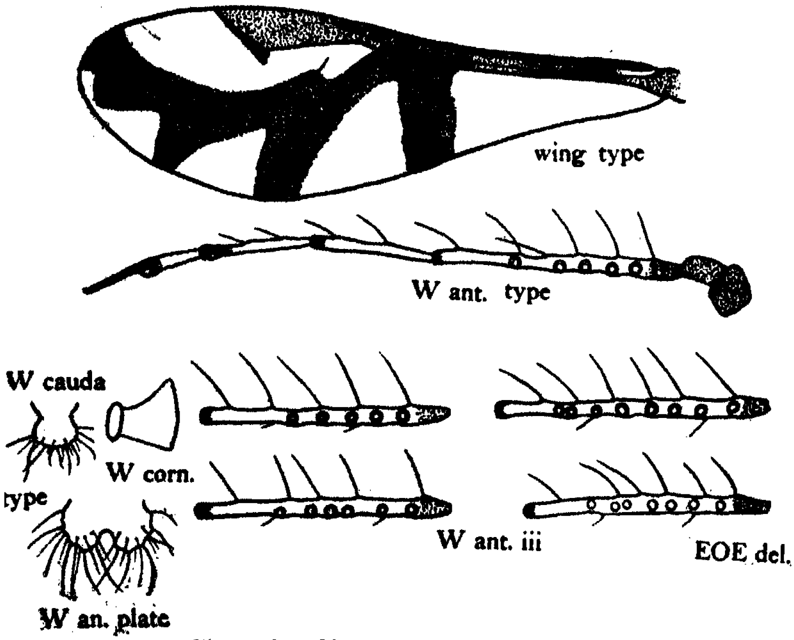

Figure 29.—*Mysocallis kuricola* (Mats.)

drawing; radial sector vein so very faint as to appear entirely absent; length of the front wings 2 mm. Abdomen pale green with three or four pairs of large black tubercles on the sides in front of the cornicles (the number is difficult to make out on the mounted specimens on hand); these tubercles bearing several spines. Cornicles dusky, widest at the base, somewhat constricted before the mouth which is slightly flared, 0.08 mm. long and 0.10 mm. in diameter at base. The paratypes also show that the diameter of the base is usually as great or slightly greater than the length. Cauda distinctly knobbed, dusky, 0.06 mm. long. Anal plate normal.

NYMPHS—Pale green, the bodies covered with long hairs some of which have small knobs at the ends.

HOST PLANTS, LOCALITIES, ETC.—The material was collected in two lots as follows:

1. On Kuri, *Castanea sativa* Mill. (listed as *C. vulgaris japonica* A. DC.), and on Kunugi, *Quercus serrata* Thunb., Nishigahara, Tokyo, June 5, 1913. Collection number 76.

2. On Kuri, *Castanea sativa* Mill., Nishigahara, Tokyo, Oct. 2, 1913. Collection number 106. In this lot were a large number of specimens which were apparently mature, but their wing pads, while almost perfect in structural details, were very small and rudimentary as if the development had been suddenly and permanently retarded.

Myzocallis, species

Of the five winged viviparous females of this very interesting species not a single one possessed a complete antenna necessary to complete determination. The species is pale green, small, about the size of *Myzocallis quercus* (Kalt.) which it resembles in wing venation. The four or five pairs of abdominal tubercles are concolorous with the abdomen; there are four very long spines on the front of the head and five or six shorter knóbbed spines on the inside margins of antennal articles I-III; basal half of III with three sensoria. A single apterous viviparous female shows the filament of the antennal article VI to be about twice as long as the base. The body is covered with long knobbed spines.

Host plant—Taken on the undersides of the leaves of Kunugi, *Quercus serrata* Thunb.

Locality—Nishigahara, Tokyo.

Date of collection—May 15, 1913.

Collection number—41.

Myzocallis, species[4]

A single winged viviparous female with parts of both antennæ missing. The color is pale green with the antennæ pale, the legs green with the tips of the tibiæ and the entire tarsi dusky. The antennæ of a nearly matured winged nymph has the base of VI 0.10 mm. and the filament 0.4 mm. long; article III, though partly missing, has 11 sensoria on the full length. Wings pale with a noticeably short radial sector.

[4] The species on bamboo described as *Takecallis bambusæ* Mats. appears to be the species described as *Myzocallis arundicolens* (Clarke). It is common at Berkeley, Cal.

Cornicles pale dusky, with wide mouth, 0.06 mm. long and about the same basal diameter. Taken on Hōnoki, *Magnolia hypoleuca* S. & Z., Nikko, June 9, 1913. Collection number 83.

Chromaphis celticolens, new species

Figure 30

WINGED VIVIPAROUS FEMALE (Type)—Selected from 7 good specimens. Length 1.6 mm., width (paratype) 0.65 mm. Prevailing color yellow; antennæ pale with dusky area near the middle of III and black on the tips of III-VI. These black areas, when examined closely under high magnification, have pale irregular areas mosaic-like or not unlike conventional

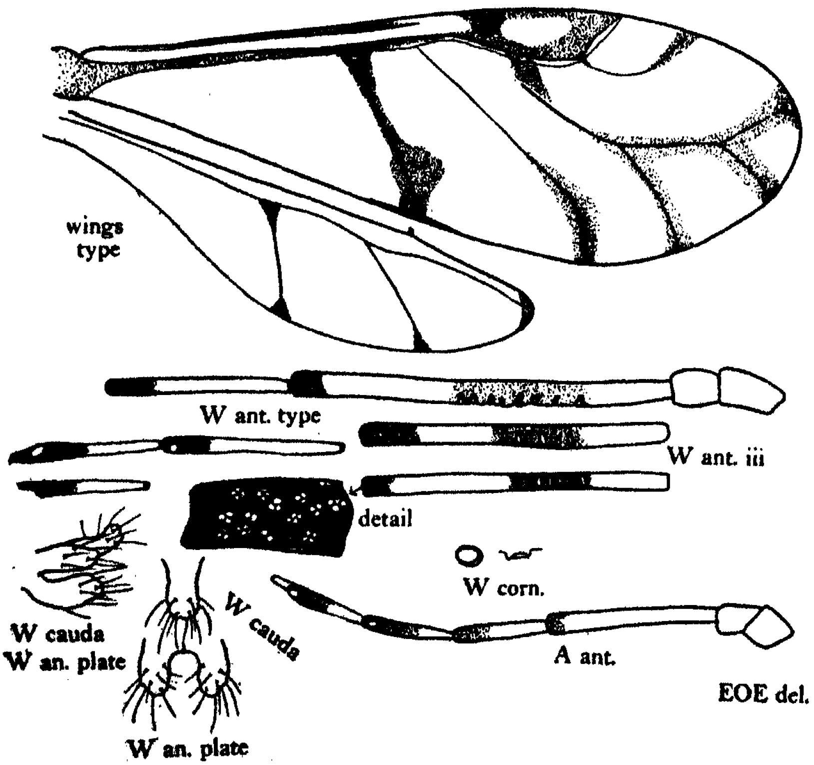

Figure 30.—*Myzocallis celticolens*, new species

flowers; lengths of the articles: I, 0.10 mm.; II, 0.07 mm.; III, 0.62 mm.; IV, 0.30 mm.; V, 0.29 mm.; VI, 0.25 mm. (base 0.21 mm., spur 0.04 mm.); total 1.63 mm. Sensoria on III transversely oval and occurring in a row near the middle or slightly toward the base from the middle, the number being 7 on the right and 8 on the left member. Paratypes have from 5 to 8, a majority having 6. Articles V and VI have the usual number. Rostrum extending to the 2nd coxæ. Thorax dark-yellow or amber. Legs pale with the apices of the femora and the tarsi dusky. Wings having venation and markings as shown in the accompanying illustration, length of the primary wings 2.9 mm. Abdomen yellow or greenish with dusky dorsal spots. Cornicles pale dusky, little more than pores, about 0.025 mm. diameter at the mouth. Cauda pale, faintly knobbed, 0.09 mm. long. Anal plate deeply constricted at the middle.

APTEROUS VIVIPAROUS FEMALE (Paratype)—A single specimen which may not be fully mature. Length 1.85 mm., width 0.7 mm. Prevailing color yellow? (no color notes). Antennæ with dusky markings on the tips of articles III-VI; lengths of the articles: I, 0.05 mm.; II, 0.06 mm.; III, 0.28 mm.; IV, 0.15 mm.; V, 0.15 mm.; VI, 0.14 mm. (base 0.13 mm., spur 0.04 mm.); total 0.83 mm. The body is clothed with a few simple hairs.

NYMPHS—Somewhat paler than the adults.

HOST PLANT—Enoki, *Celtis sinensis* Pers. (listed as *Cetis*).

LOCALITY—Tokyo.

DATE OF COLLECTION—Aug. 1, 1913.

COLLECTION NUMBER—98.

Phyllaphis, species?

What appears to be a species of this genus was represented by a few apterous females. The color is dark reddish purple, the body being covered with white powder. The cornicles are short, dark and wider than long. The cauda is conical with a constriction near the middle, giving the apical part a knobbed appearance, and with a conical base. The anal plate is bilobed.

Taken on Maki, *Podocarpus macrophylla maki* Sieb. (listed as *P. chinensis* Wall.), Nishigahara, Tokyo, May 24, 1913. Collection number 57.

Trichosiphum kuwanai Pergande

Only apterous viviparous females were taken on Kunugi, *Quercus serrata* Thunb., Nishigahara, Tokyo, May 15, 1913. Collection number 40.

Eutrichosiphum, new genus

Type: *Trichosiphum pasaniæ* Okajima

This new genus has been erected to embrace the type named above, which differs from the other members of the genus *Trichosiphum* in having but 5-articled antennæ.

Eutrichosiphum pasaniæ (Okajima)

Figure 31

A number of winged and apterous viviparous females were in this lot. All of the winged females have five articles as given by Okajima in his original description of the species[6]. Inasmuch as the apterous form has not been described, the following brief notes may be of interest:

Apterous viviparous females—Length 1.3 mm., width 0.8 mm. Prevailing color shiny black. Body entirely covered with rather long stiff hairs. Antennæ pale dusky with tips darker and with few long hairs; lengths of the articles: I, 0.05 mm.; II, 0.05 mm.; III, 0.25 mm.; IV, 0.11 mm.; V, 0.24 mm. (base 0.09 mm., filament 0.15 mm.); total 0.7 mm. As will be seen the antennæ are 5-articled as in the winged form. Rostrum long, reaching beyond the base of the abdomen. Legs short, dusky, hairy. Cornicles black, somewhat swollen in the middle with both ends small, recurved, 0.35 mm. long, their entire surface closely beset with very short, scale-like

[6] Bul. Col. Agric., Tokyo Imp. Univ., vol. 8, no. 1, pp. 23-26, pls. iv and v, Sept. 1908.

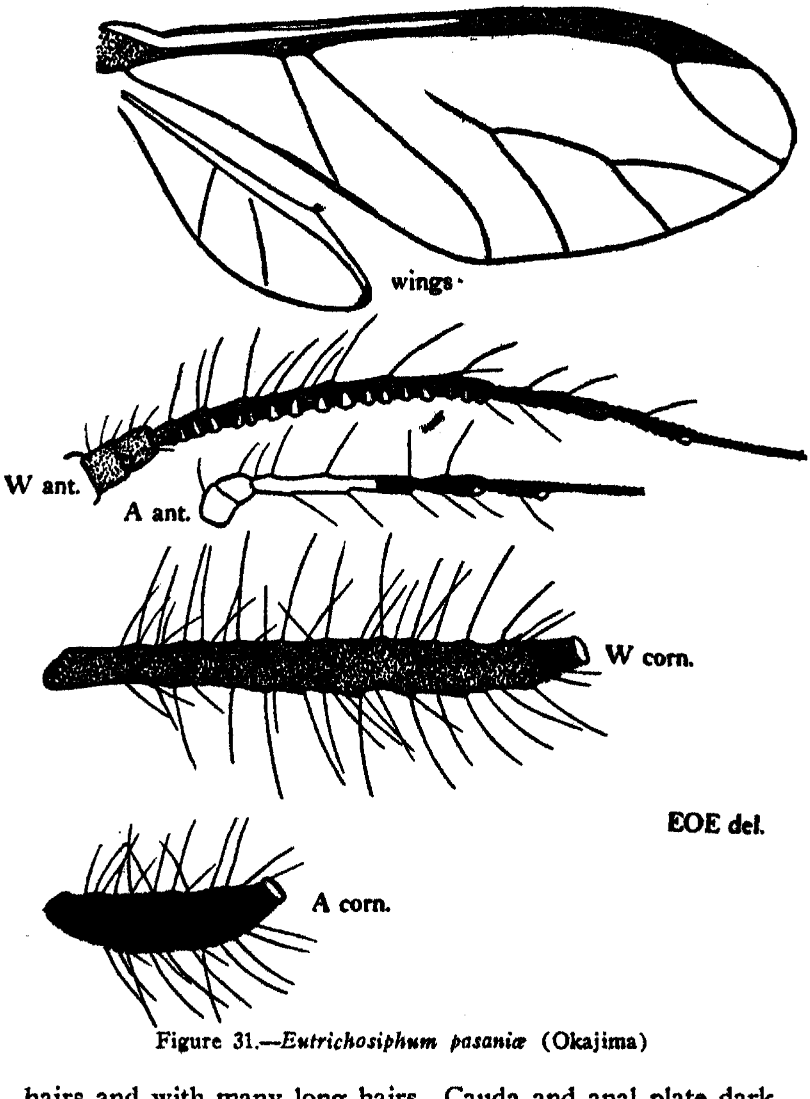

Figure 31.—*Eutrichosiphum pasaniæ* (Okajima)

hairs and with many long hairs. Cauda and anal plate dark, hairy and broadly rounded.

Host plant—Shii, *Castanopsis cuspidata* Schot. (listed as *Pasania cuspidata* Oerst.).
Locality—Nishigahara, Tokyo.
Date of collection—Sept. 14, 1913.
Collection number—104.

Lachnus pinidensifloræ, new species

Figure 32

WINGED VIVIPAROUS FEMALE (Type)—Selected from four individuals. Length 2 mm., width 0.7 mm. Prevailing color dark-brown to black. Body hairy; head black. Antennæ dusky throughout with the apical portions of III-VI black, covered with long hairs; lengths of articles: I, 0.07 mm.; II,

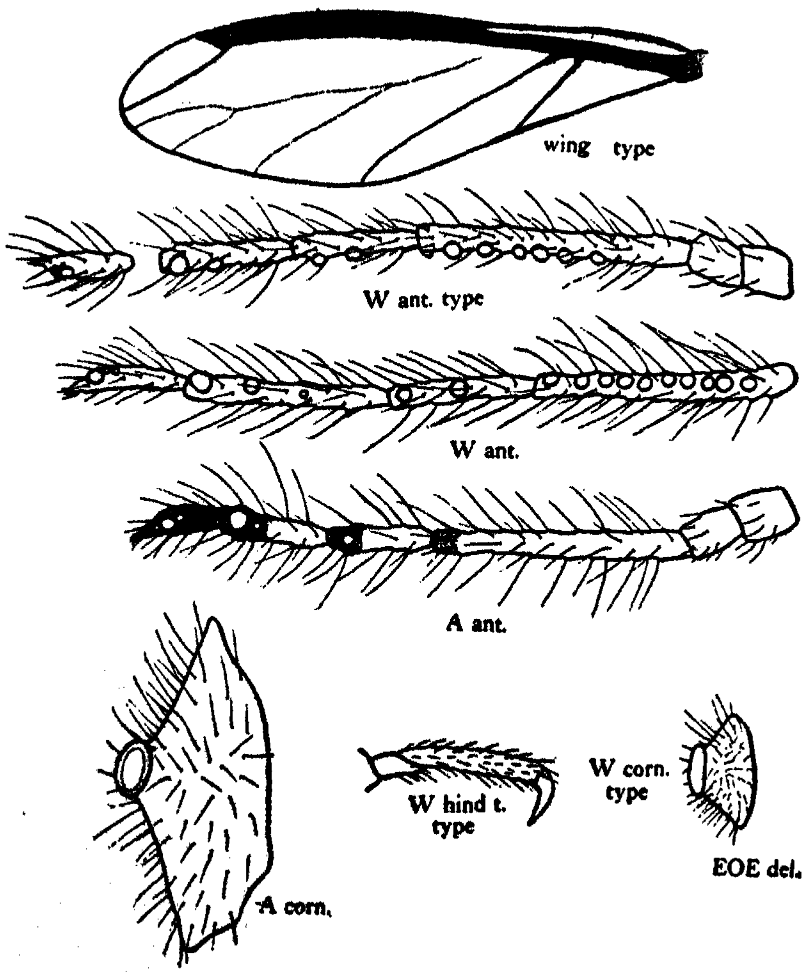

Figure 32.—*Lachnus pinidensifloræ*, new species. Wing reduced from scale.

0.09 mm.; III, 0.46 mm.; IV, 0.21 mm.; V, 0.22 mm.; VI, 0.15 mm. (base 0.12 mm., spur 0.03 mm.); total 1.20 mm. Sensoria large and circular, distributed on the left member as follows: III, 7 in a row; IV, 2; V, 2; VI with the usual number. Paratypes have on III, 10-12; IV, 0-3; V, 0-3. Rostrum long, reaching to the middle of the abdomen. Thorax black. Coxæ, trochanters and tarsi black, femora pale with black tips, tibiæ pale in middle with both ends black. Wings narrow, venation as shown in drawing; length of front wings 4.3 mm. The alcoholic specimens have the wings stained a deep-wine color. Abdomen dark reddish-brown with black markings. Cornicles black, hairy, wide at base and with slightly flaring mouth, 0.09 mm. long and 0.19 mm. diameter at the base. Cauda black.

Apterous viviparous females (Paratypes)—Four mature and several immature specimens. Length 3.5 mm., width 2 mm. Prevailing color dark reddish brown with silvery markings on the dorsum due to white wax. Body hairy. Antennæ dusky with the apices of III-VI black; all articles hairy; lengths of articles: I, 0.09 mm.; II, 0.10 mm.; III, 0.43 mm.; IV, 0.17 mm.; V, 0.18 mm.; VI, 0.13 mm. (base 0.10 mm., spur 0.03 mm.); total 1.10 mm. Sensoria large and distributed as follows: III, none; IV, 0-1; VI, 1-2; VI normal. Abdomen with many small black spots, especially at the bases of the numerous hairs. Cornicles black, hairy, very wide at base and small at the mouth which is slightly flared; length 0.2 mm., diameter at the base 0.57 mm.

Host plant—Ahu-matsu (Japanese red pine), *Pinus densiflora* S. & Z.

Locality—Nikko.

Date of collection—June 10, 1913.

Collection number—80.

Lachnus, species

Only apterous forms of this species were taken. The length averages 3.8 mm., the width 2.3 mm. Prevailing color black with reddish-brown markings on the back. Antennæ black and pale brown, about one-third as long as the body; the large circular sensoria distributed as follows: III, none; IV,

0-1; V, 2-3; VI, 1-3 (not counting the usual ones in the process). Cornicles black. On *Kara-matsu, Larix leptolepis* Murr., Nikko, June 9, 1913. Collection number 78. (The color notes were given under number 82?).

Lachnus, species

Represented only by apterous specimens. Length 5 mm., width 3 mm. Prevailing color shiny black with white dorsal markings. Antennæ pale-brown and black, hairy, half as long as the body, with the large circular sensoria distributed as follows: III, none; IV, 1-3; V, 2-3; VI with the usual ones. Cornicles black, hairy and very wide at base. On Tsuga, *Tsuga sieboldi* Carr., Nikko, June 12, 1913. Collection number 79.

Pterochlorus tropicalis Van der Goot
(Pterochlorus japonicus Mats.)

Figures 33 and 34

Winged viviparous female—Selected from nine good specimens. Length 2.8 mm., width 1 mm. Prevailing color shiny black throughout. Body very hairy. Antennæ black, covered with short hairs; lengths of the articles: (another specimen) I, 0.13 mm.; II, 0.10 mm.; III, 0.78 mm.; IV, 0.34 mm.; V, 0.34 mm.; VI, 0.20 mm. (base 0.13 mm., spur 0.07 mm.); total 1.89 mm. The sensoria are circular and distributed in a row as follows: (selected specimen) III (right) 11, (left) 8; IV (right) 3, (left) 3; V (right) 1, (left) 2; VI with usual number; others have the following: III 13-20, IV 5-9, V 2-4. Rostrum long, reaching beyond the middle of the abdomen. Wings infuscate with light areas in the front pair as shown in the accompanying drawing. Hind wings with a white line just below radius vein; a decided network of small lines on the front wings. Length of front wings 4.5 mm. Cornicles wide at base, hairy, black, length (one example) 0.25 mm., diameter at the base 0.58 mm. Cauda black, rounded and very hairy.

Apterous viviparous females—Five good specimens. Length 4.2 mm., width 2.5 mm. Prevailing color shiny

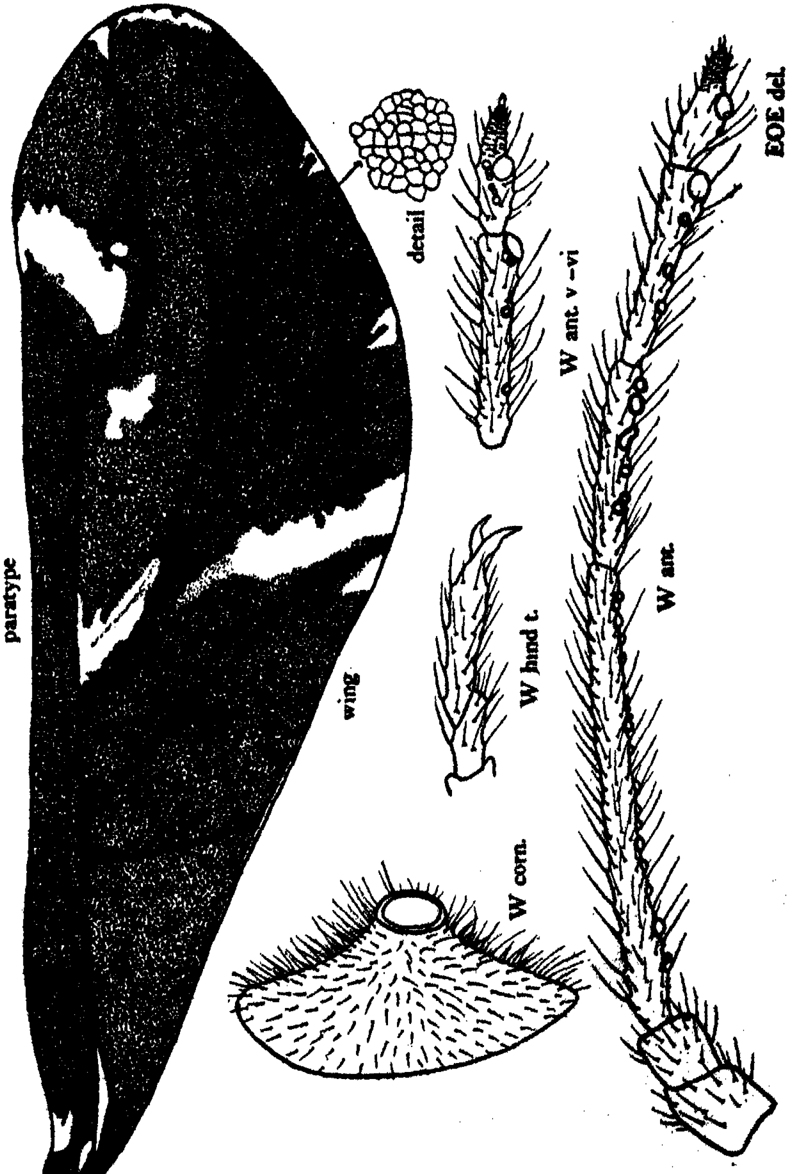

Figure 33.—*Pterochlorus tropicalis* Van d. Goot. Winged viviparous female

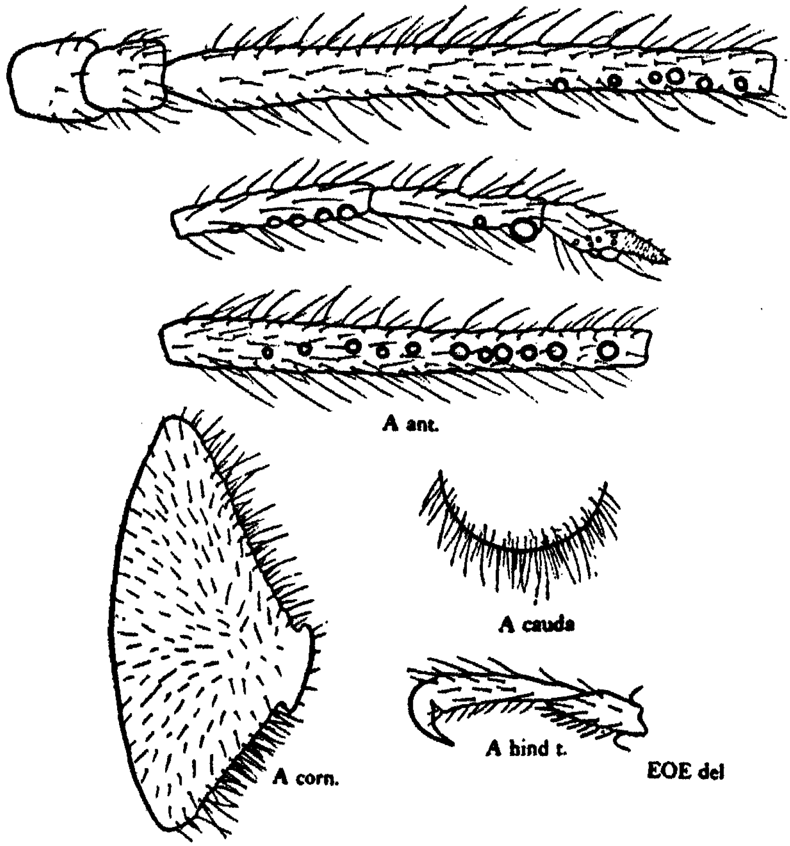

Figure 34.—*Pterochlorus tropicalis* Van d. Goot. Apterous viviparous female

black. Body hairy. Antennæ black, hairy; lengths of articles: I, 0.13 mm.; II, 0.15 mm.; III, 1.10 mm.; IV, 0.36 mm.; V, 0.32 mm.; VI, 0.24 mm. (base 0.15 mm., spur 0.09 mm.); total 2.30 mm. Sensoria large, circular and arranged as follows: III, 1-15; IV, 2-5; V, 1-2; VI with usual number. Cornicles black, hairy, 0.36 mm. long and 0.74 mm. wide at the base. Cauda black, hairy and rounded.

Host plants—On Kunugi, *Quercus serrata* Thunb., Kashiwa, *Quercus dentata* Thunb. and Shii, *Castanopsis cuspidata* Schot. (listed as *Pasania cuspidata* Oerst.).

Locality—Tokyo.

Date of collection—May 15, 1913.

Collection number—39.

REMARKS—This species is so close to *Pterochlorus tropicalis* Van der Goot[6] that it is without hesitancy so determined here. The sensoria show a slight variation in number, there being in the Japanese species many more on article III of both the winged and apterous forms and more than the usual 1 on V of both forms. In Van der Goot's description the cornicles are described as "nearly reduced pores," while on the species from Japan they are not only distinct but might well be considered large.

Prociphilus cratægi Tullgren

Figure 35

The winged viviparous females were collected on Sanzashi, *Cratægus cuneatus* S. & Z. (listed as *Mespilus cuneata* S. &

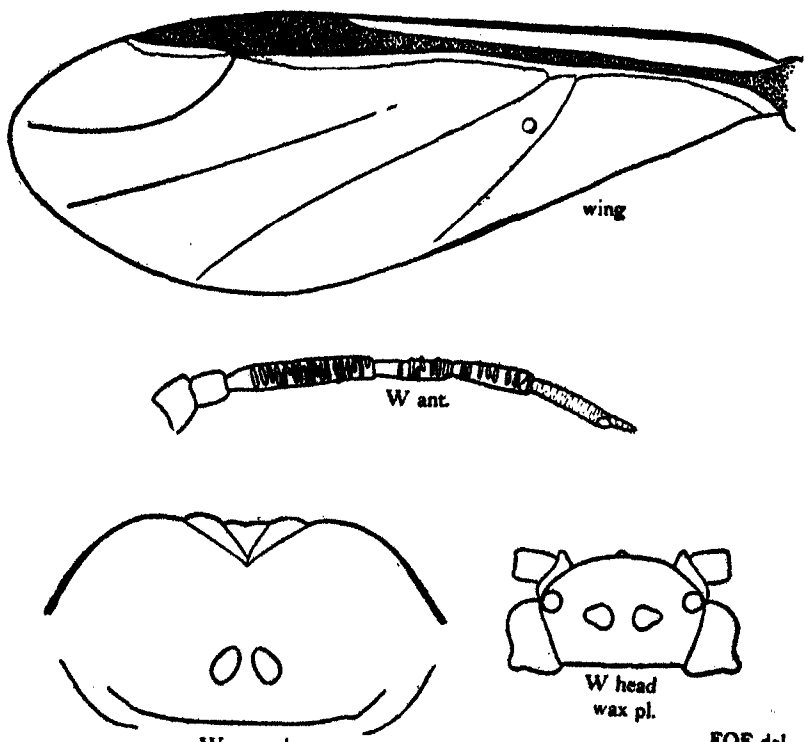

Figure 35.—*Prociphilus cratægi* Tullgren

[6] Rec. Ind. Mus., vol. 12, pt. 1, no. 1, pp. 3-4, fig. 2, Feb. 1916. (Orig. desc.).

Z.), Tokyo ? (locality not given), June 10, 1913. Collection number 88. This material was checked up with specimens received from P. Van der Goot (through John J. Davis), taken in Holland, and from Prof. F. V. Theobald, England.

Prociphilus osmanthæ, new species

Figure 36

WINGED VIVIPAROUS FEMALE (Type)—Selected from nine good specimens. Length 3.3 mm., width 1.6 mm. Prevailing colors black and dark olive-green. Head dark. Antennæ black with the bases of III-VI pale; lengths of articles: I, 0.07

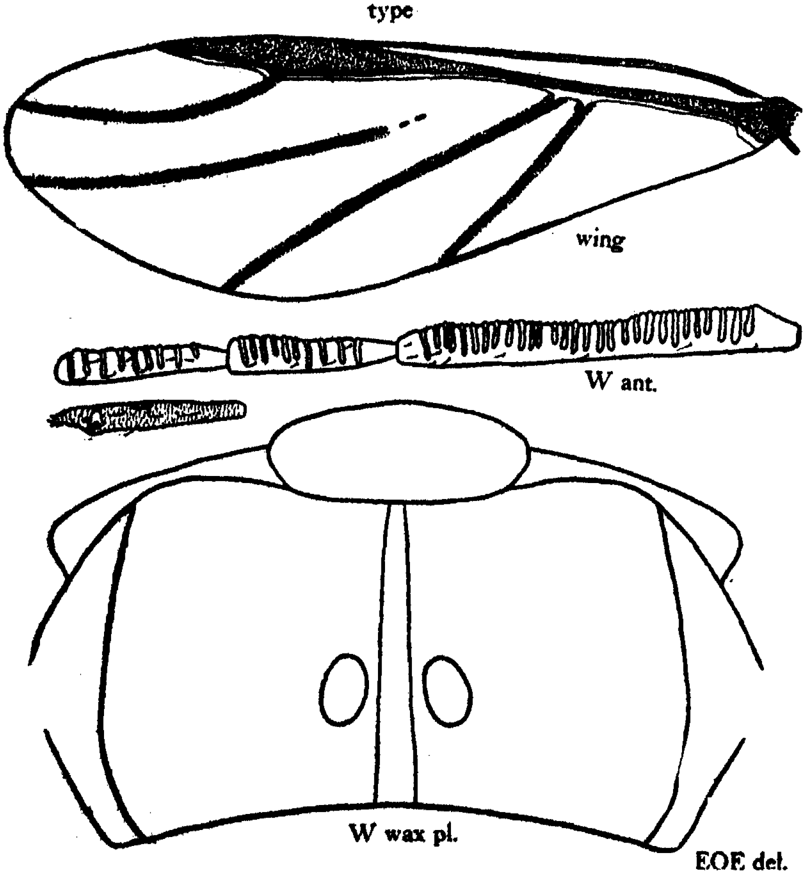

Figure 36.—*Prociphilus osmanthæ*, new species. Wing greatly reduced

mm.; II, 0.10 mm.; III, 0.64 mm.; IV, 0.265 mm.; V, 0.265 mm.; VI, 0.30 mm. (base 0.25 mm., spur 0.05 mm.); total 1.64 mm. Sensoria transversely narrow and distributed as follows on the left member: III, 29; IV, 10; V, 9; VI with the usual number. Paratypes show the following variation: III, 27-31; IV, 9-12; V, 8-12. Rostrum reaching to the base of the abdomen. Wax plates of the mesothorax oval and located just back of the middle. Legs black with the bases of the femora pale. Wings infuscate along the costal margin and at base; veins narrowly border with darker; length of the front wings 6 mm. Abdomen dark, with the ventral surface olive-green. Mounted specimens appear pale.

NYMPHS—Dark with abdomen transparently brownish, thorax pale-green, the wing pads dusky. In other respects much like the adults.

HOST PLANT—Hiiragi, *Osmanthus aguifolium* B. & H.

LOCALITIES, DATES, ETC.—Taken as follows:

1. Yamaguchi-Ken, May 24, 1913. Collection number 58.
2. Tokyo, May 29, 1913. Collection number 67.

REMARKS—This species is close to *P. cratægi* Tull., but it has many more sensoria on the antennæ and infuscated wings are characteristic. No apterous females were collected.

Prociphilus pyri (Fitch)

Figure 37

The winged and apterous females of this species were taken from pseudogalls formed on the edges of the leaves of the Japanese pear and opening beneath, Nishigahara, Tokyo, May 8, 1913. Collection number 7.

Prociphilus populiconduplifolius (Cowen) ?

The apterous females taken agree very well with determined material from the United States. Collected on Hi Ki-no-Kasa, *Ranunculus ternatus* Thunb., Nishigahara, Tokyo, May 13, 1913. Collection number 54.

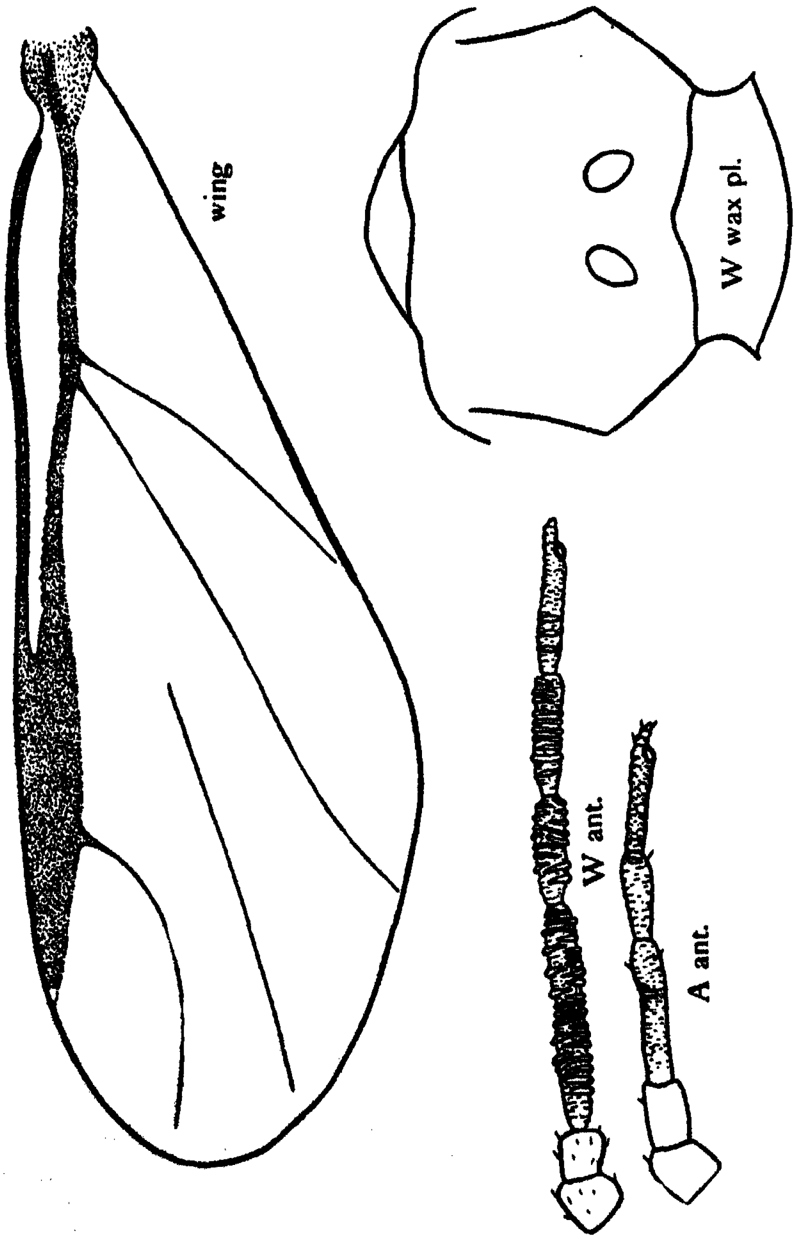

Figure 37.—*Prociphilus pyri* (Fitch)

Anœcia piri (Mats.)

(**Nippolachnus piri** Mats.)

Figure 38

WINGED VIVIPAROUS FEMALE—Selected from twelve good specimens. Length 2.8 mm., width 1.35 mm. Prevailing color dark yellowish brown with black and white (wax) markings on the dorsum. Head dark yellowish brown. Antennæ short, hairy, black with articles I, II and all but the tip of III pale-brown; lengths of the articles: I, 0.07 mm.; II, 0.08 mm.; III, 0.35 mm.; IV, 0.13 mm.; V, 0.16 mm.; VI, 0.16 mm. (base 0.11 mm., spur 0.05 mm.); total 0.95 mm. Sensoria circular or nearly so, very large, a few only small; distributed as follows: III (left) 10, (right) 11; IV (left) 4, (right) 1; V (left) 2, (right) 2; VI with 1 very large and from 3 to 4 small secondary ones. Other specimens show the following variations: III, 7-9; IV, 1-4; V, 2. Rostrum reaching to, or nearly to, the 3rd coxæ. Prothorax dark, other segments yellowish-brown. Wings long and narrow. Front wings 4.4 mm. long, with venation as shown in the drawing. Hind wings with two media. Legs black with the

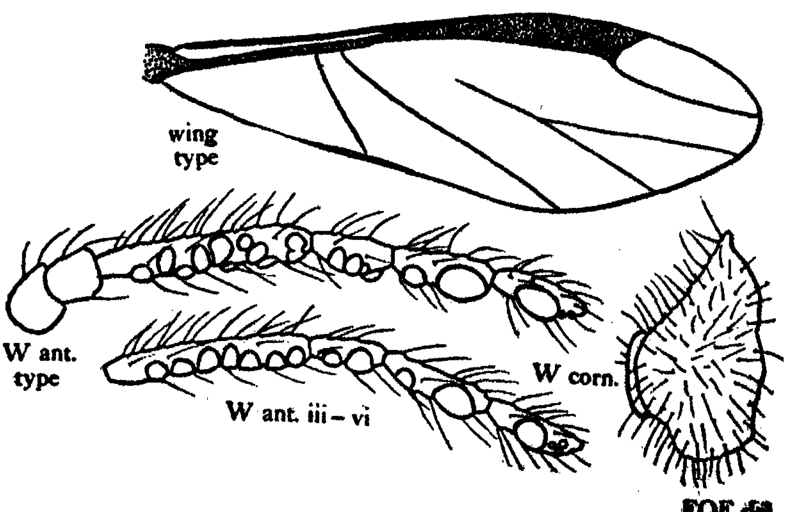

Figure 38.—*Anœcia piri* (Mats.). Wing reduced from common scale

bases of the femora and tibiæ pale. Abdomen yellowish brown with black markings and two prominent white wax bands on the dorsum. Cornicles black, hairy, very wide at the base, length 0.20 mm., width or diameter at the base 0.35 mm., diameter at the mouth 0.12 mm. Cauda, yellow with black margin; rounded and faintly constricted at base, hairy. Anal plate pale at base with black margin; rounded and hairy.

HOST PLANT—Along the midribs on the undersides of the leaves of pear.

LOCALITY—Nishigahara, Tokyo.

DATE OF COLLECTION—Oct. 2, 1913.

COLLECTION NUMBER—105.

Nipponaphis distylii Pergande

Figure 39

This very interesting species was received in considerable numbers, among which were several apterous females; the latter oval in shape, 0.8 mm. long, with 5-articled (sometimes appearing as 4) antennæ. The winged forms were taken from the leaf galls of Isu, *Distylium racemosum* S. & Z., Tokyo, June 2, 1913. Collection number 71. The apterous females were taken from oval galls on the same plant at the same time and given the collection number 71a. The specific name given by Mr. Pergande[7] was *distychii,* derived from *Distychium,* the supposed host plant. This is clearly an error in spelling, as the host plant is *Distylium.* The specific name has therefore been corrected to *distylii.*

The genus *Nipponaphis* is, indeed, very close to *Cerataphis,* and except for the horns on the apterous forms of the latter could hardly be considered as separate. The absence of cornicles is usually given as a characteristic of *Cerataphis,* but all of the author's specimens of a large series of the type species, *C. lataniæ* (Boisd.), have cornicles as large as those found in *Nipponaphis.* The peculiar aleyrodid-like form of the apterous female is lacking in *N. distylii* Perg.

[7] Entomological News, vol. 17, p. 205, June, 1906.

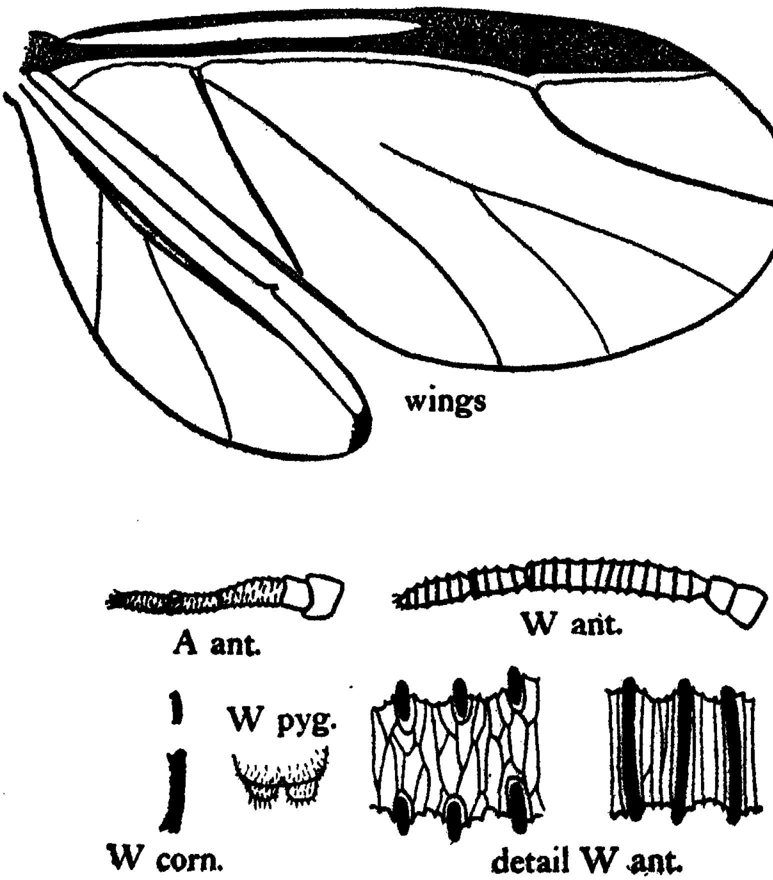

Figure 39.—*Nipponaphis distylii* Pergande

Nipponaphis cuspidatae, new species

Figure 40

Winged viviparous female (Type)—Selected from thirteen specimens. Length 1.35 mm., width 0.9 mm. Prevailing colors from black to dark-purple. Head very dark. Antennae, short, 5-articled, as shown in the drawing; lengths of articles: I, 0.04 mm.; II, 0.05 mm.; III, 0.46 mm.; IV, 0.19 mm.; V, 0.15 mm. (base 0.13 mm., spur 0.02 mm.); total 0.89 mm. Sensoria narrow ring-like, nearly equidistant from each other and numerous on all articles except the first two. Rostrum

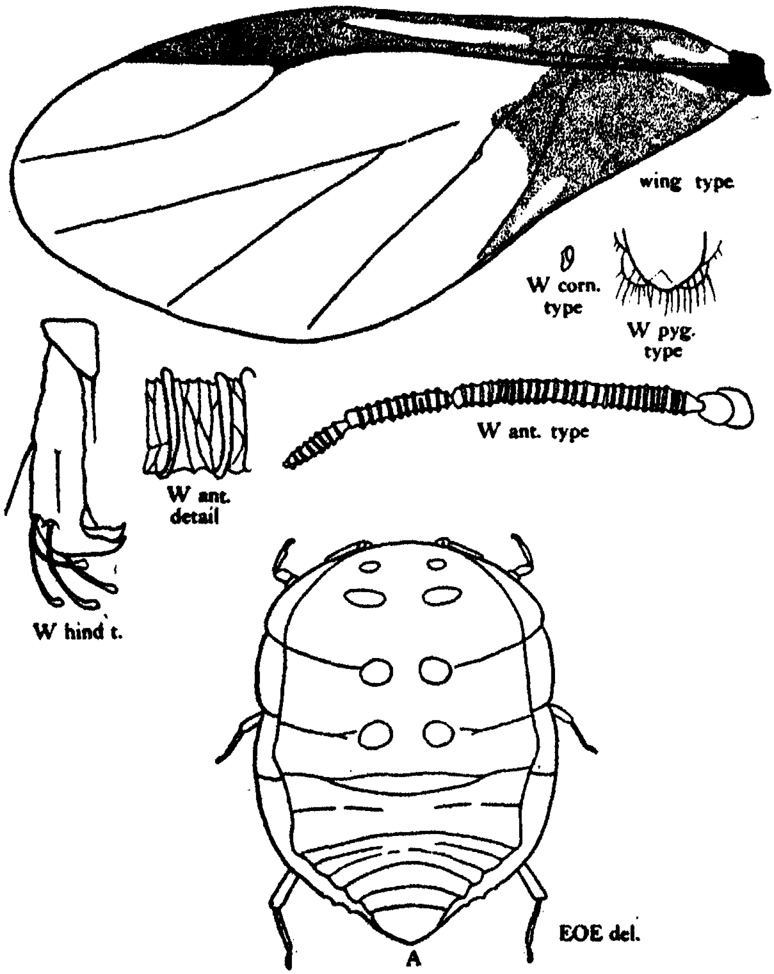

Figure 40.—*Nipponaphis cuspidatæ*, new species

reaching just beyond the 3rd coxæ. Thorax dark-purple and shiny black. Front wings as shown in the drawing, with the costal border and base infuscate and 3.1 mm. long. The hind wings are also somewhat infuscate, especially along the veins. There are 2 media veins. Legs dusky throughout, the tarsi with four large knobbed digitules. Abdomen very dark purple. Cornicles indistinct, little more than pores. Cauda hairy, blunt at tip, 0.11 mm. long and 0.15 mm. wide at base. Anal plate hairy and distinctly bilobed.

Apterous viviparous females (Paratypes) — Several specimens. Length 1.7 mm., width 1.3 mm. Prevailing color dark-purple; body slightly covered with white powder; nearly hemispherical in shape with the sides perpendicular and the surface somewhat depressed on the dorsum. In general appearance these females somewhat resemble the nymphs of certain aleyrodids, but are usually more robust. The epidermis, when cleared, shows a mosaic-like structure. All of the appendages are very small. Antennæ minute, indistinctly 3-articled and held close to the body. Legs small and appear attached to the sides of the body. The cornicles, if present, are not visible on any of the specimens although many were thoroughly cleared (in clearing in KOH the bodies literally went to pieces so that only fragments could be studied). Cauda broadly rounded. Anal plate indistinctly bilobed.

Nymphs—Dark purple and covered with white powdery wax (color notes do not specify whether these are the nymphs of one form or of both winged and apterous forms).

Host plant—Shii, *Castanopsis cuspidata* Schot. (listed as *Pasania cuspidata* Oerst.). The apterous females are clustered along the twigs in a more or less fixed position as specimens remained on the twigs after the long trip across the Pacific.

Locality—Nishigahara, Tokyo.

Date of collection—May 12, 1913.

Collection number—27.

Remarks—This species is certainly close to *Cerataphis,* where it would have been placed except for the fact that it does not have the characteristic horns of that genus.

PROCEEDINGS

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IV

GEOLOGY OF THE NORTHERN END OF THE TAMPICO EMBAYMENT AREA

BY

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INTRODUCTION

The attention of the writer was first directed to the eastern coast of Mexico as an oil field in 1890, during which year Mr. Josiah Owen, then of Eagle Pass, Texas, and later an associate for many years in coal and oil investigations for the Southern Pacific Company, made a reconnaissance trip through the region between Tampico and Tuxpam, and sent samples of heavy oil and asphalt for examination, together with a general statement as to the oil conditions, which he considered highly favorable.

In 1899 the matter was brought to the attention of Mr. C. P. Huntington as well worth investigation by the Southern Pacific Company, but it was thought at that time to be too far removed from other interests of the Company.

In 1908 the subject was again placed before the management, and an examination was ordered. Prof. W. F. Cummins, who was well acquainted with the geology of the coastal oil fields of

Texas, and who had had a year's experience in connection with artesian water investigations in northeastern Mexico, was placed in charge of the work, which began with an effort to connect the known geological section of the Texas side of the Rio Grande with the formations of the Mexican oil fields. The results of this work, as given in a paper entitled "Tertiary Deposits of Northeastern Mexico"[1] show that the Gulf Coast Tertiary deposits which carry the Texas oil are not represented in the Tampico-Tuxpam oil fields, but that the oil formations there are a continuation of the Cretaceous.[2]

During the years which have followed, the geologists of the Southern Pacific Company have continued work in this area under the direction of the writer and much information has been accumulated regarding the stratigraphy and some good collections of fossils have been made, the most of which were placed in the hands of Dr. R. E. Dickerson, Curator, Department of Invertebrate Paleontology, California Academy of Sciences, for identification.

It is proposed in this paper to give briefly the results of our work and, based on Dr. Dickerson's and Dr. W. S. W. Kew's determinations of the fossils, to show as nearly as possible the ages of the formations encountered. Descriptions of the collections have been made by Dickerson and Kew in a separate paper[3].

THE AREA

The region under consideration is a narrow belt of country on the eastern coast of Mexico, beginning just north of the twentieth parallel and extending to the twenty-fourth. From Nautla to Tampico it comprises the entire coastal strip lying between the Cordilleras, or Sierra Madre Oriental, and the waters of the Gulf of Mexico. North of Tampico it is bounded on the west by the Cordilleras and on the east by the Tamaulipas range, thus forming the valley through which runs the railway between Tampico and Monterey.

This area is the northern portion of what has been called the Tampico Embayment.[4] It is economically important because

[1] Proc. Cal. Acad. Sci., 4th Series, Vol. V, No. 6.
[2] Dumble, "The Occurrences of Petroleum in Eastern Mexico as Contrasted with those in Texas and Louisiana." Trans. A. I. M. E. August, 1915.
[3] A Medial Tertiary Fauna from Northeastern Mexico. Proc. Cal. Acad. Sci. 1917, Vol. VII, No. 5.
[4] Some Events in the Eogene History of the Present Coastal Plain of the Gulf of Mexico in Texas and Mexico. Journal of Geology, Vol. XXIII, No. 6, p. 481 et seq.

of the vast quantity of petroleum that has been developed in it during recent years. It is geologically important not only on account of the oil, but also because it furnishes the key to certain heretofore unsolved problems regarding the relationship of adjacent land areas to continental growth.

This area, some 300 miles in length, will not average 50 miles in width. Its greatest breadth, which is less than 100 miles, is found along the course of the Panuco River and its tributaries, whence it narrows both to the north and to the south.

PHYSIOGRAPHY

Topographically, the area as a whole is a plain sloping gently gulfward. Along its western border are low ranges and ridges, rarely exceeding 300 meters in height, caused by the strong folding and faulting of the Cretaceous rocks together with some of those of earlier Tertiary age which form its basement. To the east of these its undulating surface is broken by hills of erosion and by peaks of intrusive basaltic rocks. North of the Panuco River these interruptions are less numerous than they are to the southward. The most prominent remnantal elevations are found in a series of peaks, mesas and ranges beginning at Chicontepec and stretching northeastward to the Otontopec range which ends near Tantima. This forms the divide between the drainage of the Panuco and that of the Tuxpam River.

Between these two rivers are two intermediate coastal basins which have been carved out and are drained by the Cucharas and the Tancochin and a like service is performed by the Cazones and Tecolutla for the area between Tuxpam and Nautla.

The principal drainage system north of the Panuco is the Soto la Marina and between it and the Conchos River, along which we found exposures of typical Gulf Coast Tertiaries, lie the mountain masses of the Sierra de San Carlos and the Sierra Cruillas of the Tamaulipas range. These mountains extend westward to within 15 miles of the railroad south of Linares, greatly narrowing the valley at that point.

Much of the surface is covered by the dense vegetable growth of the semi-tropics and for the most part the so-called

roads are only trails. Good exposures of the rock materials are, therefore, scarce except along drainage channels and certain hillsides, making it difficult to trace the continuations of any of the formations over any considerable area. If we add to this the fact that fossiliferous horizons are comparatively few and frequently discontinuous, the difficulty of accurate correlation of the beds of separated areas will be readily apparent. It is for this reason, doubtless, that some confusion has arisen.

Publications

The publications bearing directly on the geology of this area are not very numerous.

Among the earlier papers relating to the eastern coast of Mexico, those by Deshayes, Heilprin and Sapper give only the results of their observations on the Pliocene of Yucatan.

The first definite statement regarding the geology of this particular district is that of Böse in his itinerary of the trip from San Luis Potosi to Tampico, published in the Guide Book for the excursions of the International Congress of Geologists in 1906.

Böse regards that part of the massive limestones with rudistes near Tamasopa and Micos, and which is last seen between El Abra and Taninul, as Meso-Cretaceous and equivalent to the Cenomanian or Vraconian. These include the limestones now called Tamasopa. The shales and marls with limestone bands which overlie these and are well exposed between Valles and El Abra he classes as Neo-Cretaceous, although no fossils were found in them. The yellow to gray argillaceous shales in the plain east of Taninul he says probably belong to the Tertiary, although he found no fossils, and states that they resemble the Pliocene of Tuxpam and Papantla.

This was followed and added to by Villarello in his Report on the Oil Regions of Mexico[5], which gives clear and satisfactory descriptions of the various geological formations of the region, although later discoveries may necessitate a different reference as to the age of some of the deposits there described.

Villarello refers the massive grayish limestones along the front of the Sierra Madre Oriental to the Meso-Cretaceous,

[5] Bull. 26, Inst. Geol. Mex. 1908.

and the overlying shales and sandstones, which extend from near Victoria to the zone embraced between Valles and Taninul, to the Neo-Cretaceous. He describes these beds in the vicinity of Valles as shales, marls and occasional slates with intercalated limestones and sandstones with calcareous cement and says they are unconformable with the massive limestone. With these he also includes the interbedded limestones and sandstones occurring south and southwest of Tantoyuca.

The yellow nummulitic rocks of the San Jose de las Rusias range he refers to the Eogene, but considers all of the yellow argillaceous shales, marls, and calcareous beds south of the Tamaulipas range as Neogene and equivalent to the beds at Tuxpam and Papantla. He suggests the name Papantla for these beds. He includes in these Neogene beds the argillaceous shales east of Las Palmas and Tamuin which form the greater part of the Mendez of Jeffreys.

The Neogene to the south of the Panuco River, as described by Villarello, comprises yellowish fossiliferous calcareous rocks, such as are found outcropping in the neighborhood of Papantla, Coazintla and elsewhere, overlain by sandstones, bluish gray shales and slaty marls and reddish clays. These Neogene deposits rest upon interbedded limestones and sandstones similar to those near Tantoyuca and are overlain in places by Quaternary sediments.

These Neogene beds are broken and in places overlain by basaltic rocks and tuffs.

In 1910 Engerrand and Urbina of the Mexican Geological Commission made a preliminary survey of the Yucatan peninsula. They record Miocene fossils from Tizimin*, but regard all others as Pliocene or Pleistocene.

Böse, in Bulletin 20 of the Mexican Geological Commission, reports on the geology of Chiapas and Tabasco. No Cretaceous was observed later than the rudistes limestone (Tamasopa?). Extensive deposits of shales, clays, sandstones and limestones were found carrying a fauna composed almost altogether of nummulites and orbitoides. These he refers to the Eocene. Overlying them, he finds a series of dark shales, clays, and limestones which he describes under the name of the Semijovel division. He states that this division may embrace beds of both Oligocene and Miocene age, but that the greater part

* Bul. Mex. Geol. Soc., Vol. VI., p. 119.

of the fossils appear to belong to the Miocene. Near Macuspana and elsewhere in Tabasco he found beds containing fossils which he referred to the Marine-Pliocene.

Engerrand describes the fossils from Zuluzum near Palenque in Chiapas, which he regards as Miocene.

The beds occurring on the Isthmus of Tehuantepec (outside a small exposure of the rudistes limestone) carry an abundant fauna, but the specimens are not well preserved. The determinations of species by Dall, Toula, Böse and others and their conclusions as to age, while appearing to agree on the Pliocene or later age of these deposits, seem to indicate that a portion of them may be older than this reference. This is apparently sustained by Böse[6], who found similar beds at Santa Maria Tatetla, northwest of Veracruz, from which he described a number of species as Pliocene but later states that since larger and more careful collections have been made he considers the age to be Miocene.

It will, therefore, be seen that while Eogene fossils were recognized north of the Tamaulipas range in the district of San Jose de las Rusias, and both Eogene and Neogene sediments found south of the Isthmus of Tehuantepec, nowhere within the area of the Tampico Embayment were Tertiary deposits observed which were referred to horizons earlier than the Miocene.

This was the condition when the oil geologists began operations.

In Science of February 10, 1911, Dumble, reporting on the results of two years' work in Northeastern Mexico, reports the discovery of Oligocene deposits at San Fernando on the Conchos River and in the San Jose de las Rusias region and suggests the probable Cretaceous age of the blue shales underlying the San Fernando beds of the Oligocene in the Panuco district, which in turn were succeeded by later beds as seen at Tuxpam.

In 1910 Jeffreys made a report on the geology of eastern Mexico which, while it may not have been published, has been the basis of much that has been written by others. In this report he takes the same view of the age of the deposits in this area as that stated above.

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[6] Bull. 22, Mex. Geol. Comm.

He describes the lower members of his Cretaceous under the names of Tamasopa and San Felipe, corresponding closely to the Tamasopa and San Juan of our classification. To the Mendez he refers the entire series of blue shales succeeding the San Felipe and extending eastward to and beyond Mendez. He gives these a thickness of 3000 to 3500 feet. In his section, which is reproduced by various authors, he shows the Mendez shales involved in the folding of the other Cretaceous rocks between Valles and San Felipe and states that the San Felipe beds grade upward into the Mendez and downward into the Tamasopa.

The base of the Mendez of Jeffreys is the equivalent of our Papagallos, but the top is probably Tertiary.

To the Tertiary he refers the fossiliferous beds around Tanlajas on the extreme western border of the area, the beds around Ozuluama, which he considers practically their time equivalent, and the overlying Temapache series.

In Science for June 7, 1912, Dumble reported the discovery of Eocene fossils at Alazan, northwest of Tuxpam, and gave further details of the occurrence of the San Fernando and Tuxpam beds (Miocene?) in this region.

Garfias, in his article on The Oil Regions of Northeastern Mexico[7], reviews the descriptions of the various formations as given by different geologists, adds his own observations of the region, and gives in tabular form a tentative correlation which embodies the facts brought out after Jeffreys's report by the finding of Eocene fossils at Alazan. This shows the Mendez shales as originally described, including shales of both Upper Cretaceous and Eocene age.

De Golyer[8] uses the names Tamasopa, San Felipe and Mendez for the formations found in the Furbero field, but refers both his San Felipe and Mendez to the Eocene, because of the fossils found at Alazan. He also claims an unconformity between his San Felipe and the beds he considers Cretaceous.

Huntley[9] also uses the same names for the same formations, but regards the entire Mendez of Jeffreys as Eocene.

[7] Economic Geology, Vol. X, p. 195.
[8] Trans. A. I. M. E., LII, pp. 266 et seq.
[9] Trans. A. I. M. E., LII, pp. 275 et seq.

I. C. White[10] quotes the opinion of Dr. C. W. Hayes, suggesting a Laramie age for the San Felipe and Valles beds.

A number of the geologists who have worked in this area and collected valuable data have been unable to publish it because of the character of their engagements. The writer thankfully acknowledges the assistance through co-operation and criticism of a number of these gentlemen.

General Features

At first appearance the geology of this area does not seem at all complicated, but some misunderstanding and confusion have arisen from the fact that through the entire area the predominating material entering into and forming the floor of this Tampico embayment is blue shale. At its northern end the shale was proved to be Cretaceous by its position and as it was unfossiliferous and little physical change was observed, this interpretation was applied to cover all similar shales found south of these. But, it transpires that in addition to these Cretaceous blue shales there are also blue shales of Eocene and Oligocene age and these predominate south of the Tamesi River.

The eastern face of the great plateau is composed of limestones of Meso-Cretaceous age and the Rudistes limestones of Micos canyon are found as far south as Chiapas. The disturbed area at the foot and immediately in front of the main mass shows the Meso-Cretaceous limestones folded, faulted, and overlain by later beds which are also folded. From the San Juan Hills in Coahuila to Aquismon in San Luis Potosi these overlying beds appear to belong to the upper or Neo-Cretaceous.

The beds found overlying the Meso-Cretaceous of the hill country south of Aquismon have few of the characteristics of the Neo-Cretaceous of the region northward and represent such different conditions of sedimentation and fauna as to make such a reference of them impossible. Fossils are scarce in these beds but in the deposits overlying the Meso-Cretaceous in Chiapas Böse found orbitoides and nummulites that were clearly of Eocene age and similar forms occur south of Aquismon. It is, therefore, probable that in the hill country be-

[10] Bull. Geol. Soc. Am., Vol. 24, p. 253.

tween Aquismon and Chiapas, the greater part of the San Juan and Papagallos which constitute the Neo-Cretaceous of the northern basin are either overlapped or replaced by these Eocene-Tertiary beds, outcrops of which extend eastward almost to the margin of the Gulf.

The Coastal Slope lying east of this disturbed or foothill zone is largely occupied by deposits of Oligocene age as far north as the Tamaulipas Mountains and these Oligocene deposits extend along the eastern face of this range as far as the Conchos River. The only other sedimentary deposits noted are deposits of the Quaternary and Recent which are not very extensive.

Basalts and other rocks of igneous origin occur as intrusive peaks, dikes, and flows.

CRETACEOUS

The Mexican geologists have divided the Cretaceous, of which they have a very complete section, into Eo-Cretaceous, Meso-Cretaceous and Neo-Cretaceous in place of the two divisions, Lower Cretaceous and Upper Cretaceous, recognized in the United States.

The Meso-Cretaceous of the Mexican authors includes the upper portion of our Lower Cretaceous and the lower portion of our Upper Cretaceous.

It will appear from a comparison of the fossils that the line between our Lower and Upper Cretaceous—that is, between the Vola or Buda limestone and the Woodbine or Dakota sands—would be represented in the Meso-Cretaceous by a line drawn below the Tamasopa limestone.

While, therefore, the heavy limestones below the Tamasopa may be properly correlated with our Comanche, it would not seem allowable to include the Tamasopa in such reference.

MESO-CRETACEOUS

The Meso-Cretaceous limestones of the Tamasopa gorge, as described by Böse[11], are considered by him to represent the Cenomanian, Turonian, and possibly the Vraconian, but the Tamasopa limestone of the various reports on this region, as

[11] Guide Book Geological Congress. XXX, p. 10.

generally used, is restricted to the beds of the portion of the section which are characterized by the presence of rudistes. These are typically seen in Micos canyon and at the Choy grotto which also illustrates the cavernous condition so prevalent in this limestone.

The Tamasopa limestone is rather fine-grained, compact, creamy to gray in color, and most usually massive. It is often crystalline in structure and in places it is dolomitic.

Between the Tamesi and the Tuxpam rivers the Tamasopa limestone appears to be the principal oil producing formation, while south of the Tuxpam valley it has not been found in any of the producing wells drilled up to this time.

Villarello, describing the beds of the Meso-Cretaceous lying north of the railroad line between Tampico and San Luis Potosi, says:

"The Meso-Cretaceous is made up of limestones of a grayish color in heavy beds with a strike about 18 deg. northeast and dip of 31 deg. to the northwest. These limestones are strongly folded and faulted and constitute a great portion of the Sierra Madre Oriental which extends from the Tula district passing through the western portion of the southern and central districts of the State of Tamaulipas and afterwards enters the State of Neuvo Leon.

"The Tanchipa range rises to the west of Ebano and . . . . . is made up of limestones and shales of Meso-Cretaceous and Neo-Cretaceous age. These beds extend toward the south and are exposed in nearly the whole of the petroliferous region of Aquismon."

Of the continuation of these deposits south of the railroad he says:

"The older sedimentary rocks (of the Aquismon region) are heavy beds of a grayish colored limestone, fossiliferous in some portions, especially in the neighborhood of Choy grotto . . . . .

"These limestones constitute the Meso-Cretaceous of the region, and only the limestones in the vicinity of Xilitla probably belong to the Eo-Cretaceous.

"The Meso-Cretaceous outcrops at the following places, from the northwest of Xilitla through Tampachal and Pubuche in the Temapache Mountains, to the west of Tocomon, Aquis-

mon, and Micos and in the Colmena or Abra de Cabelleros mountains. To the east of these outcroppings and to the east of Valles the Meso-Cretaceous outcrops from the Rancho Nuevo and fraction of the Pujal on the Tampaon River to Abra and Las Palmas stations on the Mexican Central Railroad and from there extends to Tanchipa Mountains. In this range the Meso-Cretaceous limestones are covered in various places by shales and marls of Neo-Cretaceous age which come in between Valles and Abra . . . . .

"The Meso-Cretaceous . . . . . is highly folded forming anticlines and synclines sometimes very close and in general unsymmetrical."

Jeffreys describes a section in the San Dieguito Range in this region as showing at the base four feet of a dolomitized limestone with minute particles of petroleum, overlain by three feet of gray crystalline limestone which had a distinct petroliferous odor, while the overlying bed of about one foot thickness is a dark gray to almost black limestone well saturated with oil. The limestone is more or less fossiliferous throughout, hippurites and various lamellibranchs seeming to predominate.

Similar impregnations are found in heavily bedded and folded Tamasopa limestone on the eastern slopes of the Temapache mountains.

The Tamasopa limestone has been subjected to heavy folding which has formed anticlines and synclines sometimes very close and, in general, unsymmetrical, and strikes vary from 30 to 60 deg. N. of E. in the region along the railway.

Except the statement that the Meso-Cretaceous limestone forms the main body of the Sierra Madre toward the south, there is almost nothing said about it in the region between Aquismon and Orizaba.

Cummins, in his work between the Panuco and Tuxpam rivers, did not get far enough west to reach the Tamasopa limestone and saw no exposures of limestones similar to the San Juan. The most westerly exposures he observed were of materials which he believed to be Tertiary.

De Golyer, in writing of the Tamasopa south of Tuxpam, says that the main mass of the outcrop is in the Sierra Madres, the front range of which passes 28 miles west and 16 miles south of the Furbero field. The Tamasopa limestone has not been reached in any well yet drilled in this field.

He says that it "consists of hard gray, pure, compact porcelain-like limestone bedded in layers less than a foot thick and is characterized in its upper part by the occurrence of an abundance of black to dark gray and green chert nodules interbedded with the limestone . . . . . The uppermost member of the limestones which are massively bedded in the northern Veracruz and Valles region are somewhat porous and contain great solution caverns."

From this I understand that he considers the uppermost member, or Rudistes limestone of the Tamasopa, missing in this region, in which case these beds may be related to the Maltrata limestone of Böse's Orizaba section.

The Orizaba limestone (Meso-Cretaceous) of Böse consists of two divisions: The Maltrata or lower member and Escamela or upper. He describes them as follows:

"The Maltrata limestones constitute an important division, which is often of great thickness. The greater part is composed of limestones in thin beds, is without fossils, and of a clear dark gray or black color. The limestones contain numerous segregations of flint in the form of lenses. In the upper portion the flint occurs in the form of nodules and irregular bodies. In the lower part of the limestones there occur in many places intercalated argillaceous slates which are yellowish and lustrous like silk, but these never form heavy beds. In the upper part toward the boundary with the Escamela limestones, there occur gray limestones and dolomites in heavy beds in which the stratification is scarcely recognizable. Above these follow dark compact limestones which represent the passage to the Escamela limestones and which may better be considered a part of the latter. In some places there occur above the dolomites flinty limestones, and in that case the line between them and the Escamela limestone is sufficiently well marked.

"The Escamela limestones are composed of a clear gray to a dark gray limestone, in some places but slightly stratified and elsewhere in clearly distinct beds. Cherts occur only in the lower portion. There are no intercalations of slates or marls. The limestones resemble in their characters very often the Cretaceous limestones of southern Italy. They are petrographically very uniform and may be recognized with ease."

Still farther south in Chiapas he describes the Meso-Cretaceous beds thus:

"This division is much the most important in Chiapas ..... It consists of limestones and dolomites which generally occur in quite thick beds and only occasionally as intercalated lenses. Occasionally beds of limestone of brecciated structure are found. In the lower part there sometimes occur beds of limestone with chert concretions, but the upper part consists generally only of gray limestone with interbedded dolomite. It may be said that these strata everywhere contain rudistes, especially radiolites."

He adds that he himself has never observed beds in this vicinity which might with certainty be assigned to the Neo-Cretaceous.

NEO-CRETACEOUS

The upper members of the Cretaceous section (Neo-Cretaceous series of Mexican authors) as determined by Cummins from their occurrence in Northeastern Mexico[12] comprise a series of thin to medium-bedded limestones, with inocerami and ammonites, called by him the San Juan limestones, overlain conformably by a great thickness of dark shales, without fossils, called the Papagallos.

The San Juan Hills are made up of a series of thin to heavy-bedded limestones interstratified with thin beds of yellowish clay. Toward the base the limestones are shaly, dark gray in color and weather gray to whitish. Toward the summit the limestones are of bluish shade, weathering white. The uppermost beds are sandy and weather to a reddish or rusty brown color. They carry numerous impressions of ammonites, oysters and inocerami which are of forms referable to the Taylor or Austin Chalk.

The Papagallos consists of a series of very fine-grained blue or black limy clay shales, leaching brown, yellow or white. At their northern end, the type locality, and for some distance south, they carry both selenite and barite and break up into slaty particles. When broken down and fully weathered, they form a black clay which when wet makes a very stiff mud like the black waxy soils of central Texas.

The Cretaceous age of the San Juan was fully proved by its fossils and that the Papagallos shales, at the type locality, were also of Cretaceous age was evidenced by the fact that

[12] Tertiary Deposits of Northeastern Mexico, pp. 170 to 174.

while they were conformable with the San Juan they had been folded and eroded prior to the deposition of the succeeding sands and limestones of the basal Eocene. This is shown on the Salinas River at Ramones where there is a bed of sandstone lying in discordant stratification directly upon the crumpled and folded Papagallos shales. In this sandstone were found:

Venericardia alticostata
V. planicosta
Ostrea pulaskensis
Cucullæa macrodonta

These fossils are characteristic of the Midway, the lowest stage of the Gulf Tertiaries. There can, therefore, be no question as to the Cretaceous age of the Papagallos shales at the type locality.

Similar limestones and shales were found at San Felipe and Valles, west of Tampico, but here they were without fossils. Jeffreys called the former the San Felipe beds and applied the term Mendez to the overlying shale and its upward continuation east of the Sierra del Abra. With the idea that these were the continuations of the San Juan and Papagallos, Cummins traced the beds from the Papagallos Hills to Mendez and Valles.

It is about 10 miles from the Papagallos Hills where both San Juan and Papagallos formations occur, to San Juan on the railroad between Tampico and Monterey. Over that distance the shales are exposed in all the ravines and are the surface rocks except where covered by superficial drift. On the south side of the San Juan River, south of the town of San Juan, there is a fine exposure of the beds in a railroad cut. From San Juan to Montemorelos is 26 miles. The shales are seen at numerous places between these points, and only at such places as are drift-covered was the shale not seen. East of Montemorelos there are hills that are composed entirely of the shales. A trip of 9 miles was made west of the town toward the Sierra Madres, and after getting out of the river valley the road was continuously on the shales. Between Montemorelos and Linares, a distance of 32 miles, outcrops of the shales are numerous and they are also shown in

the floor of the valley for 25 miles southeast of Linares to the foothills of the San Carlos Mountains, in the elevation of which the San Juan is again brought up.

The San Carlos and Cruillas mountains, lying between the Conchos and Sota la Marina rivers, are composed of heavy-bedded, compact limestones (Tamasopa ?) overlain by thinner bedded fossiliferous limestones of the San Juan series followed by the Papagallos shale. On the northern or Conchos River face of the mountains the Cretaceous is overlain by the sandstones and clays of the Fayette substage of the Eocene which are last seen on the Choreras arroyo east of Cruillas; the Fayette is overlain in places by the San Rafael. On the southern face of the mountains the Sota la Marina drainage, on the contrary, shows the yellow sandy clays of the San Rafael directly overlying the Papagallos or earlier members of the Cretaceous.

Between Linares and Cruz the Papagallos shales were found exposed at Summit, Carrizo, and other points, and simillar exposures are found in the valley for 25 miles eastward. At Cruz they are exposed in the bed of Purificacion River and in the same river northwestward to Hidalgo, just west of which are hills composed of the San Juan limestone. The valley between these hills and the Sierra Madres shows the upturned edges of the shales which are finally cut out by the scarp of Tamasopa limestone. Between Cruz and Victoria the surface is largely covered with drift or Reynosa, but these surface deposits are cut through in many places and the underlying hardened blue shales can be seen dipping at a strong angle to the west. These shales were also seen just south of Victoria and in numerous gulches between Victoria and San Francisco. At San Francisco there is a well 90 feet deep in these shales and they are exposed at many different places between San Francisco and Gonzales where a well 1,500 feet deep was in the shale its entire depth. To the east of the railroad similar shales were found at Los Esteros and Mendez.

From this it will be seen that the valley between the Sierra Madre on the west and the Tamaulipas Mountains on the east from San Juan to Gonzales and Los Esteros is underlain throughout by a body of blue shales.

At Mendez a well was drilled which passed through a thousand feet of shale before entering the platy limestone of

the San Juan. From Mendez the shales were traced westward around the south end of El Abra Hills to Micos and San Dieguito, where they hold the same relation to the Tamasopa limestone that they do west of Cruz. They lie against the upturned edges of the limestone and extend to considerable heights above the valley.

The section along the railroad between Micos and Las Palmas is typical, showing the Tamasopa, San Juan, and Papagallos in their usual relations but disturbed and faulted, and a kilometre west of Las Palmas the Papagallos shales come in sight resting against the massive Tamasopa limestone with its rudistes fossils.

There can, therefore, be little doubt that the beds between the scarp of Tamasopa limestone at Micos and the El Abra Hills are the direct continuation of the San Juan and Papágallos of the north. East of El Abra Hills, however, later beds may also be present.

Böse says of this locality:

"On leaving San Mateo the road turns again to the east to descend to the large plateau of Valles. This plateau, covered by small hills, represents a broken up scale of Neo-Cretaceous shales. . . . . . Above Valles the structure becomes very simple. The Neo-Cretaceous beds are slightly inclined toward the east and between Valles and El Abra the shales rest almost horizontally upon the Rudistes limestone."

From the San Juan Mountains in Coahuila to the railroad line at Valles is nearly 400 miles, and throughout this entire distance, along the face of the Sierra Madres the San Juan and Papagallos formations preserve their lithological characteristics and their general relations to the Tamasopa limestone. Numerous exposures in the valley between the Sierra Madres and the Tamaulipas range show materials apparently identical with the Papagallos, and both San Juan and Papagallos (and probably Tamasopa) occur east of the valley in the San Carlos Mountains. Wells drilled at Ebano, Topila, and Panuco also prove that the same relations continue along the floor of the valley in that vicinity, as platy limestones entirely similar to the San Juan are found overlying the Tamasopa and underlying the blue shale.

At the greater number of places where shales were observed north of the railroad they have a considerable dip to the north or west. The principal exceptions to this are certain hills lying around Victoria and Cruz, which, while composed of similar materials, are horizontally bedded. This apparent discordance of stratification may indicate that these hills are not Papagallos but outliers of the Eocene sedimentation occurring south of the Panuco River.

No fossils have been reported from the Papagallos shales but they are thought to contain foraminiferal remains and should have microscopic study.

In the Aquismon region south of the railroad line Villarello classes all of the materials lying between the Tamasopa and Quaternary as Neo-Cretaceous, which classification would include both San Juan and Papagallos, and says of them:

"Unconformably upon the Meso-Cretaceous lie shales and marls and sometimes slates between which are interpolated limestones and sandstones cemented with calcareous material. All these beds belong to the Neo-Cretaceous and . . . . . outcrop over a great extent of country.

"The Neo-Cretaceous outcrops on the north of Xilitla from the Huichihuayan Hacienda through the Tierras Coloradas, Tocamon, Huihuitlan, Tampamolon, Tancanhuitz, Aquismon and Tanquin to Valles. It extends on the west as far as the base of the Temapache and Colmena mountains and eastward as far as the Tanchipa or Boca del Abra mountains.

"The Neo-Cretaceous shales have a strike varying from North 25° E. to N.E. with dips of 10 to 20° to the west of northwest. These shales are slightly folded and sometimes form cross folds, the arches of which are little raised and of very gentle slope.

"At Huihuitlan and Tierras Coloradas sheets of coal 5 cm. thick are found interpolated with the beds of sands and shales."

While some of the deposits of the Aquismon district are Neo-Cretaceous, they cannot all be so referred. Jeffreys refers the beds east of Aquismon, which he described as his Tanalajàs formation, to the upper Tertiary on the evidence

of the fossils, and states that they lie in front of the Tamasopa limestone outcrop here and to the south. He makes no mention either of Valles or Mendez in this area.

Huntley's map shows the Tanlajas beds as upper Tertiary and separated from the Tamasopa limestones lying west of them by belts of Mendez and San Felipe deposits as far southward as the map extends.

Jeffreys says his San Felipe beds are transition beds between the underlying Tamasopa limestone and the overlying Mendez shales. Limestones predominate toward the base giving place to blue shales toward the top. He estimates their thickness at not more than 500 feet. It is the equivalent of our San Juan.

Huntley describes his San Felipe formation as follows:

"This may be described as a transition series between the upper Mendez marls and shales and the underlying massive Tamasopa limestone. It begins with an occasional thin limestone shell. These increase with depth in number and thickness, being interbedded with blue shales which conversely decrease in thickness downward until the series gives place to massive limestone. These beds apparently vary in thickness from about 300 to as much as 800 feet."

It corresponds approximately to our San Juan, and on his map is confined to the eastern face of the Boca del Abra Mountains, the valley west of them, and a belt along the face of the main range.

The Mendez of Jeffreys, named from the Mendez east of Ebano, and which includes the Papagallos and probably some part of the Tertiary, is thus described:

"This formation consists of a very uniform deposit of gray to blue shales, which, in the higher levels, verge into an indurated clay or semi-marl, with a bolder fracture instead of the fine shaly appearance . . . . . From top to bottom of this Mendez marl there is practically no change in the lithological character, save some irregular beds, varying from two inches to two feet thick, of a sandy limestone."

The Mendez of Huntley is the same as that of Jeffreys, but he refers it as a whole to the Eocene. He says of it:

"The Mendez marls consist of a very uniform deposit of gray to blue shales and marls. In regions of steep folding these often show bold jointing near the surface. There is practically no change in their lithological character from top to bottom. . . . . They average from 2,000 and 3,500 feet in thickness. A few irregular beds of sandy limestone are reported in this formation, but they are not persistent."

So far as can be judged from the reports now available, south of these exposures between Micos and Valles, beds having the characteristics of the San Juan formation have only been observed as narrow detached bodies lying along the border of the Sierra Madres.

In a great many places through the region south of the railroad blue shales are found underlying the yellow clays, sands, and limestones of the Oligocene, and prior to the discovery of Tertiary fossils in such a shale at Alazan, this entire series of blue shales was supposed by us to be a continuation of those of the valley to the north and to be of similar age to the Papagallos.

The only blue shales which were originally thought to be later were found by Cummins in the region about Chicontepec and while no fossils were found, on account of the lithologic similarity of the interbedded limestones and sandstones to those on the Salinas River, these beds were tentatively referred to the Eocene.

While there is a similarity of color existing between the Alazan and Chicontepec beds on the one side and the Papagallos on the other, they differ both in composition and in weathering.

The Papagallos is prevailingly clayey, weathering first into slaty particles and finally to very black sticky soil, while the others are usually more sandy, are frequently micaceous, and often weather to grayish or yellow sandy soils or loams. The prevailing dips of the Papagallos are northward and westward and in places at rather steep angles, while the Tertiary usually dips eastward at lower angles.

South of Aquismon the scarp of Tamasopa limestone bends sharply eastward nearly to the Tempoal River, a distance of over 40 miles. It there bends southeastward again. The

continuous body of Neo-Cretaceous deposits have certainly been traced into this Aquismon Bay, and, so far as our present information goes, have not been certainly recognized in the valley south of the scarp which forms its southern boundary, except in remnantal areas.

They have been observed in a narrow outcrop stretching southeastward from Tamazunchale and in scattered areas as far south as Tecualontepec on the upper part of the Rio Espinal-Tecolutla. To the south of this they seem to have been entirely eroded.

Since the Papagallos of Aquismon Bay is identical with that farther north and shows no indication of approach to shore conditions, nor any reason to look for its immediate discontinuance, the sudden change in character of the materials southward, the Tertiary fossils of the Tanlajas beds and the finding of Eocene fossils at Alazan and of fossils of supposedly Eocene age in the underlying beds at Sabanita, gives support to the idea that a large portion, if not all, of the shales south of Aquismon belong to the Eocene, and are, therefore, of later age than the Papagallos and that the Papagallos, if it formerly extended over this area, as it most probably did, was eroded or is now covered by the beds we have called Chicontepec.

The Alazan shales are definitely proved by their fossils to be of Eocene age and are also known from similar fossils found in a well at Topila on the Panuco River. They are apparently unconformable on the underlying blue shales. Just how far these Alazan shales extend northward and what portion of the beds on the Panuco River belongs to the Papagallos and what to the Alazan or other Tertiary horizon, is unknown.

Prof. Cummins found what seemed to be the Papagallos type of shales exposed at a few localities north of the Tuxpam River, but, until better information and criteria for identification are at hand, it will be safer to treat the unfossiliferous beds of shales, clays, and sandstones, with occasional beds of limestone, which, in the region south of Panuco River, occur between the Tamasopa or San Juan and the Oligocene, as undifferentiated Chicontepec, which is referred to the Eocene.

AGE OF THE CRETACEOUS

The Tamasopa, San Juan, and Papagallos seemingly represent a long period of practically continuous sedimentation as the Tamasopa grades upward into the San Juan and the San Juan into the Papagallos, with no evidence whatever of unconformability.

While the exact contact between the Papagallos shales and the Escondido beds was not seen, the relations of the two formations in the valley of the Salado River east of the San Juan Mountains warrant the statement that the Papagallos underlies the Escondido, which is the uppermost stage of the Cretaceous of Texas.

According to Böse[18] the upper portion of the Meso-Cretaceous, here represented by the Tamasopa is of Cenomanian age and he correlates it on the basis of its paleontology with the Lower Cross Timber or Woodbine sands of the Texas region. The few fossils found in the San Juan prove it to be the equivalent of the Austin or Taylor and the Papagallos underlies the Escondido. It would, therefore, seem fairly well determined that the Tamasopa, San Juan, and Papagallos are the time equivalents of the Upper Cretaceous of the Texas section from the Woodbine to the Taylor, inclusive, and that so far no uppermost Cretaceous corresponding to the Escondido or Webberville has been observed south of the Tamaulipas barrier.

TERTIARY

EOCENE

The Eocene deposits of the Tampico Embayment area are quite different from those of the region north of the Tamaulipas range. In the latter the beds are very fossiliferous and both lithologically and faunally are identical with the various subdivisions of the Lower and Middle Eocene which have been recognized in Texas.

While the Chicontepec beds somewhat resemble the beds of the Lower Eocene of Texas lithologically, no fossils have yet been found corresponding to those of the Midway, Wilcox, or Lower Claiborne. The principal forms occurring in them

[18] Neue Beiträge zur Kentniss der Mex. Kreide.

are nummulites and orbitoides, with a few undetermined mollusks.

In the northern portion of the area, west of the Tamaulipas Range, no beds were found which, because of their fossils, could be positively referred to the Tertiary. However, certain sandy shales were seen along the railroad north of the Panuco River, and on the San Antonio River west of Cruz there are hills composed of shales which lie nearly horizontally, while the underlying shales have a strong dip northwest. These shales closely resemble the Chicontepec in composition, and Cummins considers them of that age.

Near Padillo, which is at the junction of the Purificacion and Pilon rivers, east of Victoria, similar sandy shales were observed, and these may possibly be Chicontepec also. It is not thought probable that any of the shales west of El Abra Mountains are later than Papagallos, but, from Las Palmas eastward to Mendez, part or all of the shales are probably Chicontepec, and this condition continues southward.

Chicontepec

The Chicontepec beds are best seen in the extreme western portion of the Embayment area south of Aquismon, and especially in the hills lying just east of the great Cretaceous escarpment.

In places they are strongly folded as in the Chicontepec Mountain and almost everywhere show much stronger dips than the overlying Oligocene.

The Chicontepec beds proper seem to have been folded and eroded prior to the deposition of the Alazan shales.

From a locality in the Aquismon district, some 25 miles south of Valles, Jeffreys describes the following deposits, which he names the Tanlajas formation.

The Tanlajas series, as a whole, averages probably about 1100 feet in thickness. It consists, in the main, of marine deposits of rapidly alternating sandy limestones and shales. The base is composed of 250 feet of alternating beds of thin, sandy limestones, calcareous sandstones, and gray shales. The upper portion of these beds has one or two beds of calcareous blue sandstone, weathering to dark brown, which average, in places,

three feet thick. Some of the sandy beds have a strong petroleum odor while tarry black residues are frequent along fractures and fault planes. This residuum is of a brittle texture and disintegrates on burning. In other places it will take the slickenside markings of the surrounding walls, thus assuming an extreme similarity to lignite.

Overlying this there is a long stretch of coarse limestones about 450 feet thick. This limestone is brown in color, is fossiliferous in places, showing *Nummulites*, sp. *Turritella*, sp. and *Cardium*, sp. It also contains some sandy beds and carries small pebbles of rounded black chert and sandstone.

Overlying this we have another series of alternating calcareous sandstones and shales which carries some conglomerates locally. The harder beds in this series seem to have a predominance of ripple marks.

Jeffreys states that the Tanlajas formation follows southward from this point, along the front of the Tamasopa limestone outcrop, through the State of San Luis Potosi into Veracruz and Hidalgo. He says nothing whatever of its relation to the San Juan (San Felipe) or Papagallos (Mendez) and, as he was fully familiar with those formations a few miles to the north, it can be taken for granted that he considered this entirely different and later. While Jeffreys refers this to the Oligocene, it is probably the northward extension of the Eocene beds existing in like relation to the Tamasopa farther southward. Cummins considers it of similar age to the Chicontepec beds west of El Xuchil.

Apparently, these beds become more arenaceous as we go south from Tanlajas and San Pedro, and the limestones disappear. The most of the beds reported are marls overlain by flaggy sandstones and bluish shales with few fossils except nummulites.

Sixty-five miles southeast of Aquismon, and some fifty miles west of Tuxpam, Cummins and Sands found a series of beds, the lowest members of which were seen at the crest of an anticlinal ridge on Chicontepec Mountain, a mile and a half east of the town of Chicontepec, at an elevation of about 3,200 feet. The beds are composed of yellowish brown sandstones, some being two feet in thickness and containing weather-worn boulders, inclusions, or segregations of a very hard steel gray sandstone. The boulders seemed to carry some carbonaceous mat-

ter and lignitic matter was found in the cleavage planes of the sandstones. No leaves or fossils of any kind were found.

While the sandstones greatly predominate at the base they are interbedded with yellow clays and the sands become thinner and the clay bands become thicker higher in the section. Half-way down the mountain the sandstones carry boulders of concretionary clay ironstone, some of which are as much as two feet in diameter. Succeeding these beds the clays gradually give way to shales and the lower portion of the mountain was composed of bluish gray shale interstratified with fine-grained yellowish brown sandstone in layers three to six inches in thickness, while the shale beds are as much as a foot thick.

As there was no Tamasopa limestone observed in the area where we found the Chicontepec beds the relation of the two was undetermined.

From the strong resemblance of the Chicontepec beds to those of the Eocene at Ramones, Professor Cummins was inclined to refer them to that horizon.

It will be noted that while the upper beds are very largely made up of blue shales the basal beds, instead of being limestone like the San Juan, are sandstones.

The same shales and sandstones are well exposed in the hills south of El Xuchil, and numerous seepages of chapapote occur in these blue shales in the vicinity of the basaltic dikes which cut them at many places. Carmelita Ranch lies five miles north of El Xuchil, and a mile to the eastward the bed of an arroyo shows a dike of basaltic material coming up through blue shales which have been hardened on both sides of the basalt. The shale has been impregnated by asphalt, and, away from the dike, carries masses of clay ironstone in banded nodules. At Pedernalis Ranch, which is northwest of Carmelita, a similar bed of asphaltic shale was found, and the surrounding hills were made up of gray and blue shales. At one place the shales showed several thin bands of hard sandstones with fucoid-like impressions.

The beds, described by De Golyer as succeeding the Tamasopa southwest of Tuxpam and to which he applies the name of San Felipe Beds, apparently differ considerably from the San Juan (San Felipe of Jeffreys and Huntley) of the Valles region. He says of them:

"Overlying the Tamasopa limestone and resting unconformably (?) upon it is a series of alternating impure thin-bedded limestones and gray, red, and green shales and marls . . . . . The entire formation is somewhat sandy and contains locally beds of tuff of variegated colors which contain decomposed mica and are finely porous . . . . . With the exception of one or two doubtful inliers the outcrop of the formation is confined to a narrow strip adjoining the outcrop of the Tamasopa limestone in the mountain front. The thickness of the formation varies from 600 to 1000 feet . . . . . The formation . . . . . is apparently Tertiary if one may judge from the few fossils which have been secured from drill cuttings. If such is true it is of lower Eocene age. The formation grades imperceptibly into the overlying shales series, the limestones becoming gradually more argillaceous and impure and grading finally into hard shale and in turn into soft shale."

His description of his Mendez follows:[14]

"Grading from the underlying San Felipe beds is a thick series of gray to green shales, marls and clays containing rarely thin shaly sandstones and limestones and red shales . . . . ."

"This formation outcrops, for the most part, over the entire floor of the Sabanita basin. It is the surface rock of the Furbero field proper, extending from the Oligocene hills on the east to the lava flows at the foot of the hills of the Sierra Madre on the west. The thickness of this formation at Furbero is approximately 4000 feet. No fossils have been found in this region."

"Both the altered and unaltered shales of the Mendez formation, a series of blue and gray, medium soft, fine-grained shales, more or less calcareous in places, and (when not metamorphosed) a fairly constant lithological character throughout."

The Sabanita Valley, from which De Golyer describes his Mendez and San Felipe, is 60 miles southeast of Chicontepec. Aquismon is 65 miles northwest of Chicontepec.

At Aquismon the blue shales and clays, with "practically no change in their lithological character from top to bottom", gradually pass downward into limestone interbedded with similar blue shale.

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[14] Trans. A. I. M. E. LII, p. 275.

At El Xuchil the blue and brown clays and shales are interbedded with brown sandstones, carry clay ironstone nodules in places, and gradually pass downward into sandstone.

At Sabanita the upper beds are gray to green shales, marls and clays with shaly sandstones and limestones grading downward into impure thin-bedded limestones interbedded with similar shales and with beds of tuff of variegated colors.

The materials of De Golyer's San Felipe, however, are apparently unconformable on the Tamasopa, and are very different from those found in the San Juan farther north, and if, as he suggests, such fossils as it contains are of Eocene age, his San Felipe can not possibly be correlated with the San Juan, which is undoubtedly Cretaceous. Furthermore, his overlying Mendez differs materially from that north of the Panuco River, and agrees more nearly with the upper portion of the Chicontepec beds of which we believe it to be the southern extension.

Similar shales appear in many of the exposures examined between the Panuco and Tuxpam rivers.

On the Tlacalula Ranch, northeast of El Xuchil, there are many exposures of beds similar to those between Chicontepec and El Xuchil. In many places the shales are standing at high angles and are cut by basalt dikes and frequently are impregnated with asphalt. They are blue to gray in color, interbedded with brown sandstones, and occasionally have bands of clay ironstone.

These are found in the beds of such creeks as Puente, Palma, and Coyote, and near the river Tamozus.

They are also found in the base of Mount Santo Domingo and between it and Cerro Tultepec. To the eastward they are found around Horcones and on the Buena Vista River at Alazan. Jeffreys reports them as underlying his Oligocene section at Temapache, six miles southeast of Alazan.

Southeast of Tamiahua, on the San Marcos River, Sands found good exposures of them and furnishes the following description:

"The beds are composed of bands of very hard light blue-gray, fine-grained calcareous shale which in places becomes almost a shaly limestone and varying in thickness from two inches to a foot, interbedded with softer bands of thicknesses varying from a few inches to fifteen feet. Some of these softer

bands are fine-grained clay shale, dark blue gray to red in color, and seeming to carry little or no sand in its composition. Others, on the contrary, are very sandy, and in some places, grade into a shaly sandstone with calcareous cement. No fossils were found here."

These shales occur here in gently undulating beds with prevailing dips of one to four degrees a little west of south.

These are apparently very similar to the shales called Mendez by De Golyer.

Blue shales were also observed on the Tuxpam River, west of Tumbadero, and near the coast as far south as the Arroyo Hondo, between Tecolutla and Nautla, and at many other localities in this region.

Just how far south these Chicontepec beds extend cannot be told at present, but they probably skirt the foot of the Cordilleras as far south as Nautla.

Böse does not appear to have recognized any beds referable to them in his Orizaba section.

In Chiapas, however, he finds similar beds, and states that the fossiliferous Eocene there consists of sandy shales, sandstones, clay shales, calcareous shales and limestones. The prevailing colors are red and yellow, although sandstones, shales, and limestones are occasionally gray or blue.

The Eocene fauna of this region, like that of the Chicontepec beds, appears to be almost altogether foraminifera—nummulites and orbitoides. The nummulites are found scattered over a considerable area, but the orbitoides were only found in a few localities. Dr. Paul Oppenheim, of Berlin, identified them as *Orbitoides orthofragmina,* a typical Eocene form.

Therefore, so far as our present observations go, Lower and Middle Eocene deposits such as occur in the Texas Gulf Coast region are not found on the Mexican coastal region south of the old barrier now represented by the Tamaulipas Range. Such deposits as do occur in the Mexican region, and which may represent the time equivalents of these Texas beds, are characterized by an entirely different fauna.

The succeeding Eocene beds as seen at Alazan are, apparently, unconformable on the Chicontepec. The fauna is a commingling of species occurring in the Tejon formation of the Pacific Coast with those of the Upper Claiborne and Jackson, or Upper Eocene, of the Gulf region. It has only been recog-

nized at a few localities so far, but even these remnantal deposits are of great value as proof of the direct connection of the waters of the Pacific and Atlantic oceans during the final stages of the Middle Eocene and in the Upper Eocene.

A large number of wells have been drilled in the area between the Panuco and Tuxpam rivers and from such logs as are available, it appears that all the wells which have proved good producers are drilled into the Tamasopa limestone which is encountered at depths from 1700 to 2400 feet.

The identity of the Tamasopa is fully proved by fragments of the limestone which have been blown out of the wells, in some of which fragments the rudistes are clearly present.

The drilling also shows that the Tamasopa, throughout most of this area, is overlain by the San Juan beds, but the irregular thickness of the beds so referable, showing, in place of the 800 feet usually attributed to this formation in this area when undisturbed, only 70 to 150 feet in places and occasionally seeming to be missing entirely, indicates that the San Juan was subjected to strong erosion prior to the deposition of the overlying shales. Since there is no such unconformity between the Papagallos and San Juan anywhere as is found between the limestones and shales in this area, it is evident that these shales are not Papagallos and therefore whatever thickness of Papagallos may have originally overlain the San Juan in this region was entirely removed together with a large portion of the San Juan prior to the deposition of the shales now covering them.

It is probable that a part of this shale belongs to the Chicontepec, especially in the western portion of the area, but it is also certain that a large part of it belongs to the Alazan, since samples of the drillings are identical in physical character with the typical shales and at times carry fragments of lamellibranchs like those of the Alazan. It is also possible that some part of it may belong to the San Rafael.

Just what part belongs to the Chicontepec and what to the San Rafael is as yet undetermined.

It is probable that a careful microscopic study of the drillings of the materials overlying the San Juan in connection with similar study of Chicontepec, Alazan and San Rafael sediments would enable us to draw the line between the two formations as found in the wells with some exactness.

The thickness of the Chicontepec probably exceeds 2,000 feet. De Golyer[15] cites fossils from the Tamijuin well from depth of 3150 feet which are said by Hopkins and Belt to have a decided Tertiary aspect and fossils from 2900 feet in Ganahl Well No. 1 at junction of Moctezuma and Tamuin rivers which were pronounced Tertiary by Dr. Hart. While the fossils are not named it is known that nummulites occur in the blue gray marls on the Tempoal River, as in other places in the Chicontepec, and it is, therefore, probable that the shales penetrated in these two wells are Tertiary, as stated,—but they are not Papagallos.

It has been suggested that in this region these Tertiary beds occupy a deep synclinal, none of the wells having reached the Cretaceous beds which are found so much nearer the surface to the east and west.

Alazan

Whether the fossiliferous shales at Alazan are an integral part of the lower hard blue shales or are unconformable upon them, has not yet been fully determined, but they are probably later and are certainly Upper Eocene.

The type locality of the Alazan shales is on the Buena Vista River at the crossing of the road between Alazan and Moyutlan.

At this place the stream has cut down to the blue shales and exposed that formation along its western bank and in the bed of the river for a distance of more than half a mile. Overlying the shales to the west is a hill of yellowish clay, probably Oligocene. On the east side of the river there is a broad valley covered to a depth of 20 feet or more with recent deposits.

The general body of blue shale seems to have been but little disturbed; for the most part it is smooth and evenly bedded and has a low dip to the southeast. Three hundred yards below the crossing there is a limited area which shows the surface of the shale more or less disturbed and broken, and it is here that the fossils occur. In places it appears as if small basins or potholes 8 to 10 feet in diameter had been eroded in the underlying shale and the fossil-bearing blue clays laid down in them. At other places the fossiliferous beds seem broken and piled together in every direction. The entire fossil-bearing area is not more than 200 feet in length and a few hundred yards below this the main

[15] Trans. A. I. M. E. LII, p. 266.

body of shales ends abruptly as though faulted and the water plunges into a deep pool.

The material in which the fossils occurs is very similar to that of the main body of the shales, but the fossils here are entirely confined to the disturbed and eroded area and not a single fossil was found elsewhere in this exposure and none at all was found in the main body of shale.

The fossils are fragile and while abundant in this limited locality are hard to separate from the shale.

A mile west of this locality on the Horcones road a small stream with high banks affords another exposure of the fossiliferous Alazan shales. These shales are evenly bedded and have not been folded or broken as at the first locality. They are immediately overlain by recent material so that relations were not seen. The material here is a bluish shale which weathers white, differing in appearance from the great body of shale to the north which belongs to the Cretaceous and resembling very closely beds found at Tlacolula Ranch, 18 to 20 miles west of this locality on the Arroyo Puente.

The fossils from the Alazan shales were submitted to Dr. R. E. Dickerson, who reports that they are of Upper Eocene age, containing some forms characteristic of the Tejon of California and others of the Upper Eocene of the Gulf Coast.

The following forms have been identified from these beds:

Orbitoides, sp.
Cristellaria, sp.
Corbula, sp.
Nucula (Acila), sp.
Nucula monrœnsis Aldrich
Chione, sp.
Pecten promens De Gregorio
" (Pseudamusium) calvatus Morton
" sp.
Tellina cf. subtriangularis Aldrich
Glycimeris, sp.
Mactra ?, sp.
Spisula, sp.
Dentalium, sp.
" stramineum Gabb
Cadulus subcoartatus Gabb

Conus remondii Gabb
" sauridens Conrad
" alveatus Conrad
" sp.
Cylichna, sp.
Epitonium, sp.
Drillia, sp.
" sp.
Eulima lugubris Lea
" sp.
Haminea, sp.
Galeodea, sp.
Lunatia, sp.
Mitra, sp.
Murex migus De Gregorio
Neverita cf. secta Gabb
Nyctilochus, sp.
Natica, sp.
Olivella near mathewsonii Gabb
Ringicula biplicata (Lea)
Sinum, sp.
Sinum striatum (Lea)
Surcula, new sp.
" sp.
Tritonium, sp.
Turritella cf. caelutura Conrad
Turris childreni (Lea)
" nupera (Conrad)
" acutirostra (Conrad)
" cf. suturalis Cooper
" cf. monolifera Cooper (Lea ?)
" sp.
" cf. mediavia equiseta Harris
Cerithium, sp.
Schizaster, sp.

The cuts of the Tampico and Panuco Valley Railroad in the vicinity of the Topila Hills show the Alazan marls underlying sandstones belonging to the San Rafael beds. If the Meson stage is present it has not been recognized. The Alazan marls at this locality carry fragments of a Schizaster and a few small

lamellibranchs. Similar marls with apparently the same Schizaster are found at Los Naranjos, Tempoal, Zacamixtle and elsewhere, proving in some measure the extent of the Alazan beds in this region.

Taken altogether, therefore, it would now appear that the section south of Aquismon probably corresponds closely with that described by Böse from Chiapas and Tabasco, but is more extended. The Tamasopa limestone, with occasional remnants of San Juan and Papagallos, is followed by Eocene deposits characterized by nummulites, orbitoides, etc., succeeded by Upper Eocene (Jackson) and this by Lower and Upper Oligocene.

OLIGOCENE

After the deposition of the Eocene sediments they were elevated and folded and, in this area, were base-levelled so that at the present time they form a comparatively level floor, the general surface of which is not far below the water-level of the region.

Upon this floor of Eocene sediments are found those of the Oligocene, which includes the greater part of the materials forming the various mountains, hills, and mesas of the region as well as those portions of the intervening valleys in which erosion has not reached the underlying Eocene. In many places they are penetrated by dikes and necks of basalt, and, at others, are covered by basalt flows. Some sedimentary deposits of Quaternary age also occur overlying them.

The Oligocene deposits consist of sands and sandstones, clays, marls, shales, with more or less calcareous matter, and limestone. These, where unaltered, are brown, gray, or blue, but are usually weathered yellow, which is their prevailing color throughout the region. By far the greater part of the beds are clays with more or less sand, the shales and limestones being most abundant in the middle portion of the beds.

These deposits were first studied by us on the lower Conchos River near the town of San Fernando, and that name was used to designate them[16]. Finding that the name was already in use the name San Rafael was adopted as a substitute[17].

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[16] Tertiary Deposits of Northeastern Mexico, E. T. Dumble. Science, No. 841, pp. 232-4. 1911.

Tertiary Deposits of Eastern Mexico, E. T. Dumble. Science, No. 910, pp. 901-8. 1912.

[17] A Medial Tertiary Fauna from Northeastern Mexico. Proc. Cal. Acad. Sci. 1917,

On the Conchos River and along the eastern face of the Pomeranes Mountains to the north of that stream the only beds recognized were those belonging to the uppermost part of the formation. To the southward in the Martines and San Jose de las Rusias ranges to the vicinity of Tordo Bay lower beds than those of the Conchos predominate. South of the Tamaulipas Range in the Panuco River drainage area a considerable part of the fossil-bearing deposits seem to be of this same age, while south of the Otontopec divide we find, in connection with these deposits toward the coast, a considerable development of later beds similar to those on the Conchos.

The San Rafael, as here described, includes both the Eogene and Neogene of Villarello's report. Of the former, he says:

"The Sierra San Jose de las Rusias is made up of yellowish colored nummulitic calcareous rocks which belong to the Eogene and which extend to the north as far as the vicinity of Santa Maria de las Ovejas. To the west they extend to the plain of San Jose. To the east they pass under the Quaternary and Recent formations of the Coast, and south they reach as far as the same Sierra of San Jose . . . . . These beds belong to the Eogene and form slight folds; sometimes cross-folding. The general structure is monoclinal." (P. 12.)

The overlying beds, or "Neogene," are made up in this vicinity of argillaceous shales, while around Ebano the beds he correlates with these are thus described:

"The Tertiary of this region is made up of yellow clay shales and blue or bluish gray marls. Interpolated in these marls and shales are sandstones with a clay and sometimes calcareous cementing material. These rocks outcrop chiefly, although to a very small extent, toward the west from Ebano and some portions of the plain where generally they are covered by the Quaternary and Recent formations of the Gulf Coast."

Jeffreys' section of the Tampico Tertiaries shows at the base semi-crystalline fossiliferous limestone with some shales, also a coarse crystalline limestone and the blue calcareous sandy marl. This is overlain by a soft calcareous sandy material interbedded with white nodular forms. The succeeding beds consist of coarse limestone weathering to yellow and carrying oysters. The top bed is of sandy turritella limestone with calcareous sandstone beds containing white nodular forms.

Jeffreys, speaking of the Ozuluama and Temapache regions, says:

"These Tertiaries chiefly consist of coarse limestones, fossiliferous as at Ozuluama and Topila; there are also strata of bluish limestones weathering to yellow, and some soft coarse blue sandy silt deposits underlying the former; nummulites are present in most of the limestones, but more abundant in certain sections, especially near by Ozuluama. The so-called Temapache limestones are decidedly of a higher horizon than that of the Ozuluama Series, but are very similar in lithological character. They are somewhat thicker, however, and probably ostrea are more abundant in the southern series. There are also a few more or less localized conglomerates in the Tancochin area.

"The whole series throughout are interbedded with a softer calcareous yellow sandy material, full of small white calcareous forms.

"Under what conditions these Tertiaries were deposited is difficult to estimate, but they were probably laid down in not a very deep sea.

"The Tertiary beds on the eastern side, moreover, are not homogeneous throughout. That is to say, we have beds in the southeastern and central portion which are not represented with a similar bed at the same horizon in the northeastern section."

In the vicinity of Tuxpam we find shales, marls, and sandstones overlying fossiliferous yellow limestones. Similar beds are found southward along the Cazones River and eastward almost to the Gulf shore at Nautla.

De Golyer[18] says of the beds in this region:

"Overlying the Mendez shales is a thick series of sandstones, shales, impure fossiliferous limestones and occasional conglomerates of Oligocene age. The various strata making up this formation are lenticular and grade laterally into each other. Near the front of the Sierra Madre occur beds of shale so thick that their outcrops are hardly distinguishable from those of the Mendez shales."

[18] De Golyer, A. I. M. E., p. 1906.

The comparatively superficial character of these beds is well shown in the Topila district. Here the Topila Hills, several hundred feet high, seemingly show a section of more than 1000 feet of clays with interbedded sandstones and limestones carrying fossils of San Rafael age, and yet wells drilled along their western foot show none of them.

In places these beds are very fossiliferous and based on the fossil fauna they may be divided into three stages, although possibly the two lower may be ultimately combined into one. These, beginning with the lowest, will be called the Meson, San Rafael and Tuxpam stages.

Meson

The type locality of the Meson beds is in the valleys lying between Moralillo and Meson on the trail leading from Tamiahua to Alazan. These beds consist for the most part of yellow sandy clays with some lime and sandstone. It is characterized by the large foraminifer *Orbitoides papyraceæ,* Bou. These fossils occur here in great number, but they have not been observed higher in the series. These beds, with their characteristic fossils, are also found near San Jose in the San Jose de las Rusias region underlying the San Rafael.

San Rafael

The San Rafael, from which these beds are named, is located on Zarzizal Creek, 65 miles north of Tampico. Four miles east of the town a range of hills 300 to 400 feet high is composed of beds of yellow clay alternating with bands of clayey limestones[19]. The fossils are abundant and include corals, mollusca, echinoderms and foraminifera. The corals, echinoderms and forams are quite distinctive and through them the beds of this stage are easily distinguished for a considerable distance to the north and south of the type locality.

While considerable stress seems to be placed on the limestones of this division, they are not the predominant materials, which consist of gray, blue, and yellow clays, shales, and marls, with occasional beds of sandstone. The limestones are more or less local in their development.

[19] Tertiary Deposits of Northeastern Mexico, Cal. Ac. Sc. Vol. 5, No. 6, p. 189.

Beds of San Rafael age occur in the vicinity of Tampico, both to the west of the city and between the city and the Gulf.

Among the best exposures of these deposits in the region under discussion are those found in the Topila Hills, 15 miles southwest of Tampico, where there are many good exposures of beds of limestones with characteristic fossils. There are also numerous exposures to the south, although where the limestones and fossils are lacking the identity of the beds is not so easily determined.

Jeffreys, in describing his Temapache section, which seems to belong to this stage, states that succeeding what he calls the Mendez series, there is a dark bituminous sandstone containing sharks' teeth and nummulites, overlain by limestones and occasional conglomerate carrying ostrea, pectens, nummulites, and turritella. Above this comes a hard, coarse to fine-grained limestone, replaced upwards by a hard, coarse yellow limestone with calcareous sandstone, as in the Ozuluama beds, carrying turritella, ostrea, and pectens. The top of this section is the hard Temapache limestone. Still another section is given in the Cuchares River area which shows limestones and thin beds of shale overlain by calcareous sandstone, and this by Le Pena gray limestone with nummulites. Above this there are beds of semi-crystalline limestone, some of them being highly fossiliferous, while the top is formed of turritella limestone interbedded with yellow calcareous sandstones.

The fossils found in the San Rafael stage include the following:

Foraminifera:[20]
- Orbitoides epphippium
- Nummulites radiata ?

Corals:[21]
- Orbicella cellulosa Duncan
- Orbicella, n. sp.
- Maeandrina, n. sp.
- Acropora, sp.?
- Favites ? polygonallis Duncan
- Goniastrea antiguensis Duncan
- Goniopora, sp. very similar to, or identical with, an Antiguian species.

[20] Determinations by R. M. Bagg.
[21] Determinations by T. Wayland Vaughan.

Echinoderms:[22]

Clypeaster concavus Cotteau
" sp. a Dickerson & Kew
" sp. b " " "
Eupatagus, sp. " " "
Lovenia dumblei Dickerson & Kew
Macropneustes mexicanum Dickerson & Kew
Schizaster scherzeri Gabb.

Mollusca:[23]

Ostrea, sp.
Pecten gatunensis Toula
" oxygonum-optimum B. & P.
Turritella altilira Conrad

Tuxpam

Following the clays, shales, and limestones of the San Rafael, we find another series of clays and shales which is also very fossiliferous in places as in the vicinity of Tuxpam, which place gives them their name.

The Tuxpam beds comprise yellow clays and sandy clays, blue sandy shales and bands of calcareous sandstone. For the most part, the beds seem to lie nearly flat and show little disturbance, even in the vicinity of volcanic necks.

They are well exposed around San Fernando, on the Conchos River, have not been definitely identified at Tampico, but form a large part of the surface material around Tuxpam and southward to Larios and Nautla. While the contact of the Tuxpam and San Rafael beds has not been positively observed, we may conclude that a decided unconformity exists because there are numerous small anticlinals to be seen in the San Rafael, while the Tuxpam beds seem to show little or no disturbance of this character. A further study will probably demonstrate that south of the Otontopec divide the Tuxpam beds overlap the San Rafael in many places, as they certainly do in the region north of Tordo Bay.

While certain molluscan forms seem to be common to the San Rafael and the Tuxpam, the number of species occurring in the Tuxpam is very much greater. The echinoderms of the

[22] Determinations by Dickerson & Kew.
[23] Determinations by Dickerson & Kew.

Tuxpam seem to be specifically distinct from those of the San Rafael, corals are much scarcer and there is no such number or variety of foraminifera as in the lower beds.

The following list of fossils of the Tuxpam stage is from the report of Dickerson & Kew:

Echinoderms:
- Agassizia clevei Cotteau
- Cidaris cf. loveni Cotteau
- Clypeaster cubensis Cotteau
- Macropneustes antillarum Cotteau
- Metalia cumminsi Dickerson & Kew
- Scutella cazonesensis Dickerson & Kew

Molluscs:
- Astarte, sp.
- Arca, sp.
- Antigona glyptoconcha Dall
- Cardium, sp.
- " gatunense Toula
- " lingua-leonis Guppy
- Clementia cf. dariena Conrad
- Chione cf. ballista Dall
- Glycimeris, sp.
- Meretrix, sp.
- Mya, sp.
- Macoma ? sp.
- Ostrea haitiensis Sowerby
- " trigonalis Conrad
- " sp.
- Paphia, sp.
- Panope, sp.
- Pecten gatunensis Toula
- " cf. " "
- " condylomatus Dall.
- " levicostatus Toula
- " sp.
- Tellina
- Architectonica, sp.
- Amphissa, sp.
- Conus interstinctus Guppy
- " sp.

Cypraea, sp.
Ficus, sp.
Malea ringens Swainson
" sp.
Melongena, sp.
Natica, sp.
Olivella, sp.
Sinum, sp.
Turritella, sp.
Urosalpinx, sp.
Xenophora, sp.

Böse states that the Semijoval division which overlies the Eocene deposits in Chiapas may possibly include both Oligocene and Miocene deposits. This division consists of argillaceous shales, blue clays, gray sandstones, and limestones. The fauna, which was not carefully studied, embraced *ostrea*, sp.; *pecten*, sp.; *turritella*, sp.; *strombus*, sp.; *conus planiceps*, *echinolampas*, sp.; *clypeaster* cf. *meridianus*, etc. in the shales, with some corals and pectens in the limestones. From this it would appear that there is seemingly a strong resemblance between the Semijoval and the San Rafael, just as there is between his Chiapas Eocene and the Chicontepec.

NEOCENE

North of the Tuxpam River sedimentary beds of later age than the Oligocene seem to be confined to those of late Pliocene or Pleistocene age.

In the northern portion of the Embayment area, lying between the Tamaulipas Range and the Cordilleras we find, resting directly on the Papagallos shales, beds of materials corresponding in every way to the Reynosa of Southwest Texas and Northeastern Mexico. It consists of conglomerates, gravels, and sands, with some clays and more or less calcareous cementing material, which, in many places, takes the form of caliche.

Similar beds are found east of the Tamaulipas Range and southward throughout the area.

East of the Tamaulipas Range we find overlying the Oligocene clays and sands, in a number of localities, a rather heavy

bed of broken shells, making a true coquina. In places this is found well up in the hills or forming the tops of hills. Just how it is related to the Reynosa is not known.

The Reynosa, as shown by its relations to fossiliferous beds above and below it, is Upper Pliocene and our idea is that the Coquina is of similar age.

Going southward we find, around Tampico and the Laguna Viejo, beds of sandy clay with *Ostrea virginica* and a few other shells of like recent affinities. Similar deposits occur in the area between Tampico and Tuxpam and to the south of the Tuxpam River.

All of these deposits are more or less local in their distribution, and have not been studied sufficiently to permit a fuller description.

While no fossiliferous beds of Miocene or earlier Pliocene age are known within the area here discussed, they do occur farther south and more detailed work may discover extensions of them in this region also.

The nearest locality at which such fossils have been collected and identified is Santa Maria Tatetla, Veracruz, about sixty miles south of Nautla. This was described by Böse in Bulletin 22 of the Mexican Geological Institute. Both Böse and Villarello state that a similar fauna is found in deposits occurring near Actopam and Tezuitlan which lie between Santa Maria Tatetla and Nautla.

The following is from Böse's description:

Santa Maria Tatetla is a native town in the Canton of Huatusco and 25 or 30 miles northwest of the city of Veracruz. It is situated in the bottom of a deep barranca at an elevation of 349 meters on the bank of the Rio Santa Maria, which, after uniting with several arroyos, forms the Rio Antigua and enters the gulf near Antigua. The general character of the region is that of an extended mesa almost perfectly flat, somewhat inclined towards the east and cut by numerous barrancas. Towards the north and west the mountain rises in sierritas made up chiefly of Middle Cretaceous limestones and modern eruptive rocks. The upper part of the mesa is mostly a conglomerate of eruptive rocks horizontally stratified and in all probability an upper Pliocene and Post-Pliocene Marine formation. Beneath these conglomerates there are outcrops of the Escamila

division of the Middle Cretaceous, one of these being to the south of Apasapan, and another near Santa Maria Tatetla, where there are limestone beds carrying *Rudistes, Actæonella, Nerinea,* etc. At Palmer the limestones carry *Caprina* and other Cretaceous fossils. On top of these come calcareous conglomerates, marls, and sands somewhat consolidated and sandstones carrying the fauna described as Pliocene. Above the fossiliferous beds come a conglomerate of modern eruptive rocks.

The Tertiary fossiliferous bed occurs at an altitude of 280 meters above the sea-level, and, in the bottom of the barranca, about four kilometers below Santa Maria. The bed extends eastward and the same fossils are found in a somewhat harder limestone at an elevation of 150 meters at Puente Nacional. That the beds dip to the east may be seen from the altitude of the fossil localities.

The sandstones and sand in the Barranca Santa Maria admit of two divisions: *Ostrea, Ammussium* and *Encope* are the more abundant in the lower division and in the upper there are numerous bivalves of other genera and gasteropods, but, with the exception of *Ammussium,* the species are rather scarce. Both divisions carry many forms in common and are undoubtedly of the same age.

The fauna found in this region comprises the following:

Encope Tatetlænsis, n. sp. (frequent)
Pecten Aztecus, n. sp.
" santarosanus Böse
Ammussium mortoni Rav. (frequent)
Pinna serrata Sow. (frequent)
Anomia simplex D'Orb.
Ostrea virginica Gmelin (frequent)
" sculpturata Conr.
Arca taeniata Dall.
Lucina quadrisulcata D'Orb.
" pectinata Gmelin
Laevicardium sublineatum Conr. (frequent)
" serratum Linnæus (frequent)
Dosinia elegans Conr. (frequent)
" acetabulum Conr. (frequent)
Venus ebergenyii Böse (frequent)

Solecurtus cummingianus Dunk.
" gibbus Spengl.
Semele perlamellosa Heilpr.
Panopaea floridana Heilpr.
Xenophora conchyliophora Born.
Sigaretus cfr. multiplicatus Dall.
Turritella Aguilerae Böse.
Cerithium caloosaense Dall.
Strombus pugilis Linnæus (frequent)
Pyrula papyratia Say (frequent)
Dolium cfr. galea Linnæus
Oliva litterata Lam. (frequent)
Balanus eburneus Gould.

Nearly all the fossils occur in the form of casts and it is not possible to determine a number of the species on account of the absence of ornamentation or because, being new species, they cannot be determined for want of better preserved material.

This fauna appears to be a littoral or at least comparatively shallow water one and many of the species or their kindred are still living in the adjacent sea. The Santa Maria Tatetla, Santa Rosa, and Tuxtepec species appear to belong to the same fauna and same age, which, although given as Pliocene, in the publication quoted, is now regarded (so Böse says) on account of larger and more complete collections, as Miocene.

Igneous Rocks

The igneous rocks occurring in this area are nearly all basaltic.

They occur as dikes of various widths, as plugs or bosses, and in beds forming the tops of hills and mesas.

The great number and extent of the dikes suggest that the lavas which form the caps of the hills and mesas came up as sheet flows rather than through craters.

Huntley[24] gives two maps showing the location of a number of these dikes running in different directions, together with surface flows and states that the peaks and plugs of basalt are usually found at the intersection of such dikes.

[24] Trans. A. I. M. E. LII, pp. 302, 310.

Garfias[25] has described the mushrooming of these plugs in sending out sills of basalt through the bedded limestones.

De Golyer[26] expresses the opinion that the lava cap was originally continuous over a very large part of the area, and that the flow occurred after the deposition and folding of the entire series of marine sediments.

The largest single body now remaining in this area is probably that of the Otontopec Range or Mesa, but there are many other detached mesas and hills which still show their lava covering resting upon the yellow, sandy clays of the Oligocene.

History

The movement, which, during the later portion of the Austin Chalk period, caused the formation of the Sabinas barrier in northern Mexico, was probably the beginning or directly connected with the one that began the deformation which has resulted in the present conditions of our area.

East of the Sabinas barrier the Taylor, with its coal beds and the overlying Escondido, were laid down with little, if any, interruption, and are followed by the basal Eocene without any evidence of an erosion interval between.

One hundred and sixty miles south, at Ramones, on the Salinas River, where we found the contact of the Papagallos (which represents the Taylor, in some part, at least), and the same basal Eocene, we see that the Papagallos has been strongly folded and eroded prior to the beginning of Eocene deposition. Similar folding is evident in the San Felipe-Valles region.

The initial movement in this area was, therefore, immediately following the deposition of the Papagallos and the fact that between the Panuco and Tuxpam rivers not only the entire thickness of Papagallos, but, in places, that of the San Juan was removed prior to the submergence which permitted the beginning of the deposition of the Eocene, indicates that the erosion was very active. Farther south it was even more active as the Rudistes limestone also seems to have been carried away.

The Midway or basal fauna of the Gulf Coast Eocene is found as far south as the Tamaulipas Range but has not been

[25] Journal of Geology, Vol. XX, No. 7, p. 666.
[26] Trans. A. I. M. E. LII, p. 275.

observed again north of Venezuela, 2,000 miles away. Fossils of the Lower Claiborne occur along the Conchos River not more than 30 or 35 miles from the upper end of the Embayment area, near Linares, but are not known farther south.

The waters of the Eocene sea covering the Tampico Embayment area probably came in from the south and were either entirely separated from those of the Gulf or their connection was such that the faunas did not mingle.

Toward the close of the Middle Eocene further elevation and folding took place. This is shown in the Pomeranes Mountains north of the Conchos River, in the mountains east of Burgos, south of that stream, at Alazan, and at Chicontepec. This movement is also evidenced on the Texas coast by the absence of the Upper Claiborne and the erosion of a part of the Lower Claiborne prior to the deposition of the Upper Eocene or Jackson.

The succeeding submergence clearly shows a connection in the Embayment area of the waters of the Pacific and those of the Atlantic by the commingling of the Pacific and Gulf types of fossils at Alazan where Tejon forms of the west are mingled with Jackson and possible Upper Claiborne forms from the Gulf.

The close of the Eocene was marked by further folding, elevation, and erosion.

The Oligocene submergence, which followed, seems to have affected not only the entire Gulf region, but the Carribean as well, and since almost identical faunas are reported from the west coast of Mexico, it is probable that the passage between the Oceans was still open.

With the final emergence of the Oligocene* important sedimentation in our area seems to have ceased, and was succeeded, probably during the Miocene, but, seemingly, before any great erosion had taken place, by the vulcanism which gave us the dikes, necks, and caps of basalt.

To the north and south of this area the coast was subjected to further submergence and deposits of Miocene and Pliocene age were laid down, but such Post-Oligocene submergences as may have occurred in this portion of the Tampico Embayment area seem to have been relatively unimportant.

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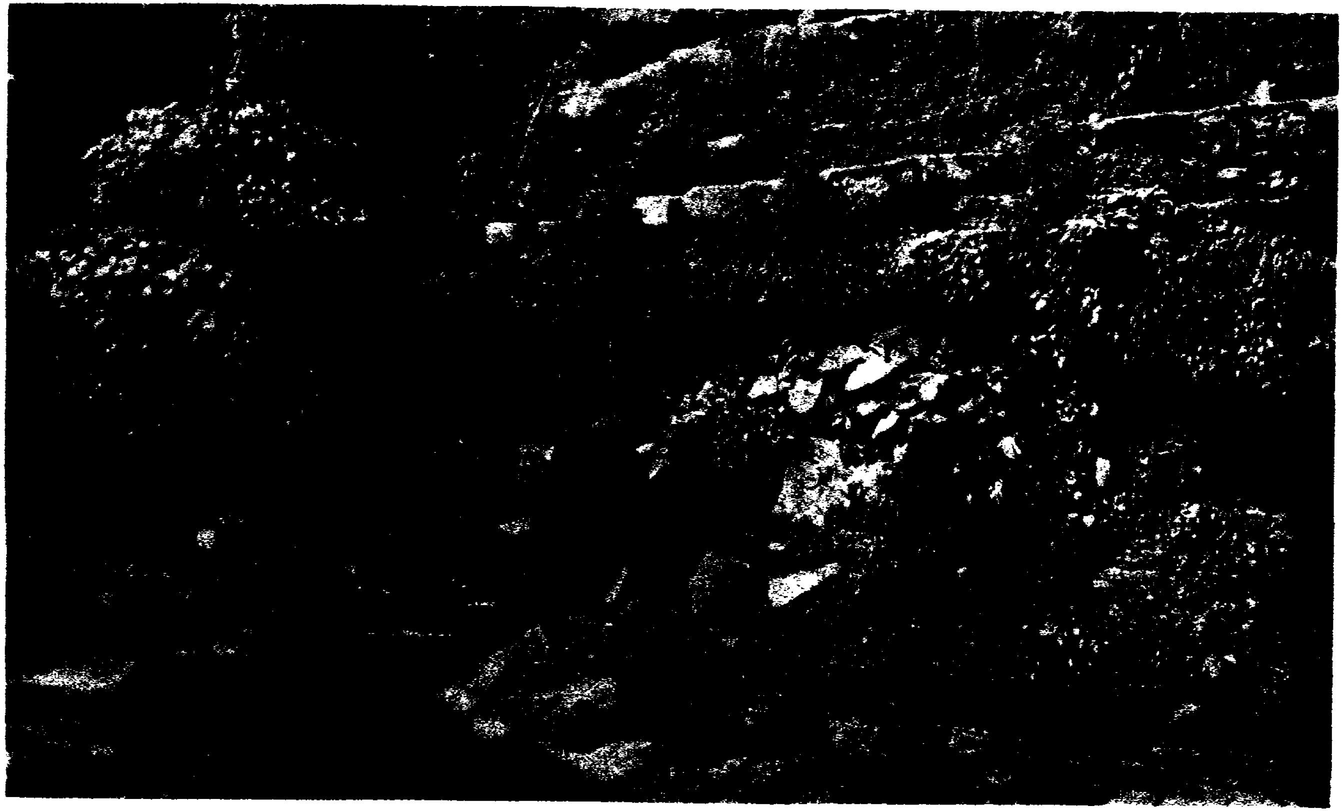
* The nummulitic limestones of the San Rafael beds are ample warrant for their reference to the Oligocene. The Tuxpam beds were included in the Oligocene because of the identity of certain ferns. Some of these ferns, however, seem to indicate a later horizon and closer collecting may necessitate a reference of the Tuxpam beds to the Miocene.



Chicontepec beds, Cuitzcuatitla near Tecoluco.

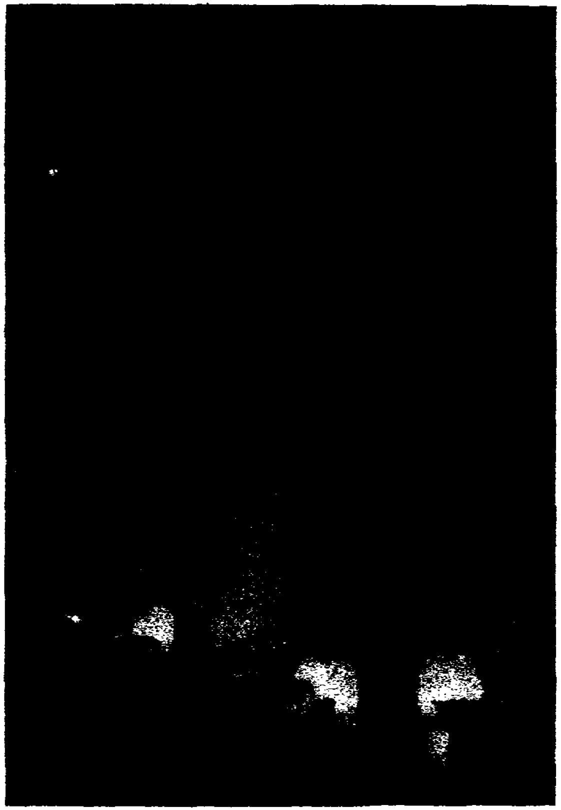


Fig. 1. Chicontepec beds near Chicontepec.

Fig. 2. Chicontepec beds. Zontecomatlan, one mile northeast Papagallos contact.

Fig. 1. Papagallos beds, south end of Papagallos Mountains.

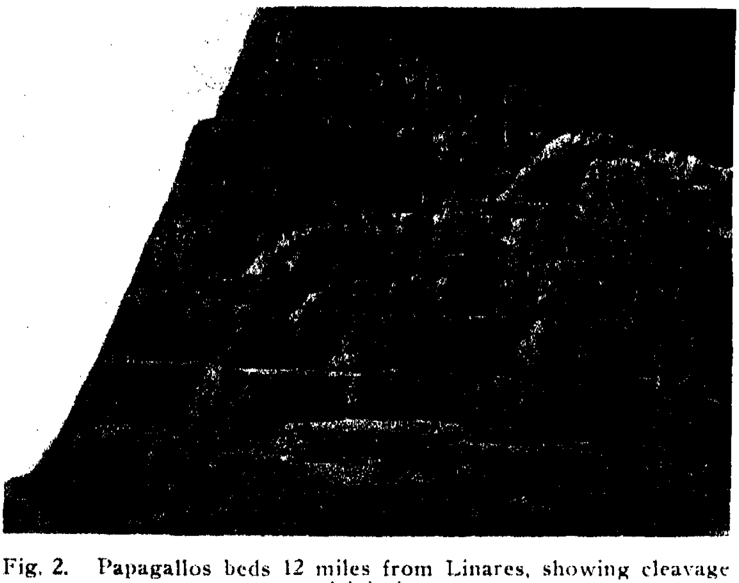


Fig. 2. Papagallos beds 12 miles from Linares, showing cleavage and jointing.

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V

THE KELP-FLIES OF NORTH AMERICA

(GENUS FUCELLIA, FAMILY ANTHOMYIDÆ)

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The genus *Fucellia* was established in 1841 by Robineau-Desvoidy (Annales Soc. Ent. France, x, 269), with the single species *arenaria*. The type specimens are lost, and the description contains at least two palpable blunders; but from the account of the habits of the adult on the French coast, it is undoubtedly identical with Haliday's *Halithea maritima*, published in 1838 (Annals Nat. Hist., ii, 186). The generic name *Halithea* is preoccupied, so *maritima* becomes the type of *Fucellia*, and is so given by Coquillett (Type-Species, 1910, 545).

The species of *Fucellia* live in the larval stage in brown seaweeds (kelp, Fucus, etc.), cast up by the waves along ocean beaches; the adults can be found all summer long on these masses, often in immense numbers. Only *maritima* and *fucorum* have been reported at any distance inland; their larval habits in these situations are unknown.

Stein has published an excellent monograph of the species of the world, 14 in number, in Wiener Ent. Zeitung, xxix,

11-27, January, 1910. Johnson closely followed this with a review of the species of our Atlantic coast and Greenland, four in number, in Psyche, xvii, 76-78; April, 1910. As the rich fauna of our west coast was only partly known to Stein, and as his paper is not very accessible, I offer a new treatment of our species, both east and west.

Generic characters.—*Maritima* shows the following characters in both sexes: front wider than one eye; a single large pair of cruciate bristles on the front; fronto-orbitals 6 in a single row, the upper 3 somewhat outcurved, the lower incurved; verticals two pairs; ocellars large, two smaller pairs behind the triangle; parafacials narrow, bare; antennæ short, with bare arista; eye small, bulging, bare, nearly round; bucca fully one-half the eye-height, bare except a single row of bristles below; epistoma slightly produced, vibrissæ above the lower edge of head, only a single small bristle above them; palpi ordinary; proboscis short, with a pair of long hairs below beyond the elbow; labella ordinary; back of head bulging, with sparse hairs. Thoracic chætotaxy[1]: postsutural dorsocentrals 3 (a rather large hair behind the third), anterior dorsocentrals 2, humeral 2 or 3, interhumeral 1, presutural 1, notopleural 2, intraalar 2, supraalar 1, a small prealar, postalar 2 (the hind one very large), anterior acrostichal 3 pairs rather large and no small hairs, posterior acrostichal 5 or 6 small pairs and 1 larger prescutellar, sternopleural 2 in front and 2 behind, prothoracic 1, mesopleural 5 behind and 1 at front lower corner; scutellum bare below with 1 marginal near base, 1 pair long apical close together, 1 smaller discal, the disk without hairs except at sides; pteropleura and metapleura bare. Front calypter projecting far beyond the reduced hind one. Hind tibia with a row of 3 or 4 erect bristles on the extensor side, the lowest subapical. Venation ordinary, costal spine present, third and fourth veins parallel, ant cv at middle of wing, the cross-veins separated by almost the length of the last segment of the fourth; last segment of fifth short, sixth slender but reaching the margin; costa setulose.

In listing the preceding characters, it is not intended to intimate that a species must have them all in order to be con-

[1] The names of the thoracic bristles are given in full here, but are generally abbreviated farther on; they are explained in Williston's Manual, my Sarcophaga and Allies, also in a valuable and easily accessible paper by Walton, Ent. News, xx, 307-314.

generic with *maritima;* for instance, in the known species the costal setules may be much larger than in *maritima* (*costalis*) or absent (*evermanni*); the lower hind stpl may be absent (*bicruciata* and *evermanni*); a few very minute hairs may occur underneath the scutellum (in some but not all specimens of *separata, costalis,* and *fucorum*); and so on. The head structure, venation, and chætotaxy, however, vary but little, and the group is decidedly homogeneous, although the species are easily separated.

Down to 1893, the genus had been uniformly referred to the family Scatophagidæ (or Scatomyzidæ), so far as I have been able to trace its history. In the year mentioned, Girschner (Berl. Ent. Zeitsch, xxxviii, 304) referred it to Cœnosiinæ; but as he included *Scatophaga, Cordylura,* etc., in the same group, this has not much significance. Becker (ibid. xxxix, 80) in the following year first definitely separated the Fucellias from *Scatophaga* and its allies. "They are," he wrote, "Anthomyids, clearly excluded from this family by having a four-segmented abdomen, cruciate frontal bristles, and a pair of costal spines at the end of the auxiliary vein." Stein accepted this disposition of them in the Palæarctic Catalogue (1908), where they stand as a subfamily, Fucelliinæ containing but the one genus.

Malloch, in a recent analysis of Anthomyid subfamilies (Canadian Ent., xlix, 408; Dec., 1917) separates Fucelliinæ from Cœnosiinæ in the possession by the former of cruciate frontal bristles and a spine below on the hind basitarsus, the sternopleurals being never in the form of an equilateral triangle.

Schnabl and Dziedzicki, Die Anthomyiden, 1911, p. 123, proposed the genus *Fucellina* for *Fucellia griseola* Fall., *signata* Zett., and *pictipennis* Beck. The principal character is that the fronto-orbital bristles are single-rowed in *Fucellina,* and double-rowed in *Fucellia.* This I must regard as purely a mistake, as they are single-rowed in all that I know. Several other characters are mentioned, but they do not remain grouped in our species, but split in all directions. Hence *Fucellina* appears to be only another in the long list of unsuccessful attempts to improve Anthomyid genera.

TABLES OF SPECIES

MALES

1. Femora largely yellow (Southern California) .*rejecta*, new species
   Femora black 2
2. Front with two or three pairs of cruciate bristles............... 3
   Front with a single pair 4
3. Front with three pairs, the lower farther apart; ant acr with scattered minute hairs between (Bering Straits)..*bicruciata* Stein.
   Front with two pairs, the lower farther apart, ant acr without scattered minute hairs (California)....*evermanni*, new species
4. Hind femora beneath at extreme base with a tuft of short spines.. 5
   Hind femora plain 7
5. Middle tibiæ on inner front side with one or two distinct bristles 6
   Middle tibiæ without bristles on inner front side (Atlantic coast; Europe) ....*maritima* Hal.
6. Hind femur at base close to the tuft of bristles with a knoblike protuberance turned toward the body, which is also beset with short spines (Greenland to Bering Straits, and down the Pacific coast; Europe) ....*fucorum* Fall.
   Hind femur with only the tuft 6½

6½. Head square in profile, the front flattened, protuberant anteriorly (Greenland; Arctic North America)......*ariciiformis* Holmg.
   Head globular, front as usual; front of wing clouded beyond middle (Kodiak Island, Alaska)................*hinei*, new species

7. With a large dark spot in apical half of wing (Greenland; Arctic North America) ....*pictipennis* Beck.
   Wing unspotted. 8
8. Middle femur with stout bristles below, which on the apical half are short and comblike; costa with long spines (California)...*costalis* Stein.
   Middle femora without such bristles, costa with short spines .. 9
9. Hind femora beneath on apical half with a close-set row of about 14 slanting bristles (Alaska) ....*antennata* Stein.
   Hind femora with only three to five bristles beneath 10
10. Prealar absent, bucca as high as eye (California)..*separata* Stein.
    Prealar present, bucca not so high 11
11. Tibiæ red, hind ones with only two or three bristles on outer front side (California; Washington)...........*rufitibia* Stein.
    Tibiæ black, hind ones on outer front side with a row of about 8, the upper small (British Columbia).....*æstuum*, new species

FEMALES

1. Femora yellow (Southern California) ....*rejecta*, new species
   Femora black 2
2. Front with two or three pairs of cruciate bristles 3
   Front with a single pair 4

3. Front with three pairs, the lower farther apart; ant acr with scattered minute hairs between them (Bering Straits)........ ....*bicruciata* Stein.
   Front with two pairs, the lower farther apart, ant acr without scattered minute hairs (California).....*evermanni*, new species
4. Tibiæ mostly or wholly reddish-yellow 5
   Tibiæ black, or paler only at the extreme base 6
5. Middle femur below with two or three scattered bristles below from base to middle; middle tibia with two small setæ on front inner side (California; Washington)...........*rufitibia* Stein.
   Middle femur without bristles below, middle tibia without setæ on front inner side (Atlantic Coast; Europe)....*maritima* Hal.
6. Wings distinctly infuscated on apical half (Greenland).......... ....*pictipennis* Beck.
   Wings not infuscated apically 7
7. Third antennal joint elongated, almost twice the second. (Alaska) ....*antennata* Stein.
   Third antennal joint but little longer than second 8
8. Bucca (below the eye) as high as the eye (California) ....*separata* Stein.
   Bucca hardly over half the eye-height 9
9. Numerous small hairs between the two rows of the ant acr ....*costalis* Stein.
   Ant acr in two rows without small hairs between 10
10. Head nearly square in profile, prominent at antennæ; sternopleural hairs long and abundant (Greenland; Arctic North America) ....*ariciiformis* Holmg.
    Head not so square; hairs of sternopleura small, sparse 11
11. Palpi wholly black (Arctic; Pacific, etc.)...........*fucorum* Fall.
    Palpi with basal half red (British Columbia) ....*æstuum*, new species

Note.—The male is unknown in *rejecta* and *bicruciata*, and the female in *æstuum*. I have placed these in the tables by analogy with the known sex, but there is a chance of error. The unknown female of *hinei* I have not ventured to place.

DESCRIPTION OF THE SPECIES

1. **Fucellia maritima** Hal.

(Figs. 1, 2, 3)

Haliday, Annals of Natural Hist., ii, 186, 1838 (*Halithea*).—Europe.

Macquart, Annales Soc. Ent. France, vii, 424, 1838 or 1839 (*Scatophaga marina*).—Europe.

Robineau-Desvoidy, ibid, x, 272 (*arenaria*).—Europe.

Lundbeck, Dipt. Grœnl., ii, (Vidensk. Meddel., 1900) 291, f. lb. (*intermedia*).—Greenland. [Stein.]

Stein, Wien. Ent. Zeit., xxix, 1910, 18.—Entire European coast, North Africa, North and South America on Atlantic side; sometimes inland (Genthin and Berlin); seems unknown from shores of Pacific.

Johnson, Psyche, xvii, 1910, 77 (*marina*).—Labrador to Florida.

Winn and Beaulieu, List of Quebec Diptera, 1915, oc. at East Bolton, Que.

Johnson made *marina* prior, but accepted the date of the séance as the date of publication.

In addition to the characters listed as generic, the species shows the following (in both sexes unless the contrary is indicated): General color brown-gray, pollinose; front red in middle, yellow toward antennæ, brown at vertex; a circle of pale pollen, interrupted behind, around the ocellar prominence; gena and bucca brown in ground color; palpi yellow; tips brownish; proboscis blackish; antennæ black, second joint sometimes brown, over half as long as third; arista straight, short, thickened for 2-5 its length. Thorax indistinctly brown above; humerus dark brown on the side, below which the pollen suddenly becomes whitish, making a pale spot which includes the lower half of the spiracle; mesopleura hairy on less than the upper-posterior half; calypters pale yellow, rim and its hairs the same; halteres yellow.

Abdomen tessellated, opaque brown-gray; in the male the first segment is longest, in the female the fourth; the male has a small and retracted hypopygium, the fifth sternite with a broad emargination behind and a narrow lobe each side. Coxæ, femora, and tarsi black, the trochanters and tibiæ yellow; front tibiæ with two small setæ on outer hind side; middle tibia with one on outer front, three small on outer hind side; hind femur with an upper-outer row of bristles double toward tip, and a sparse row below that begins about the middle; in the male there is at base below a protuberance against which the tip of the tibia closes, which bears a bunch of black spines. Hind tibia with the row behind as already mentioned, three on outer hind side, four on outer front side. Hind basitarsus with spine below. Pulvilli short, the front ones a little elongated in the male.

Wing hyaline or very slightly grayish, veins brown to yellow; setulæ on costa beginning before the tip of auxiliary and extending nearly to tip of second, but not very large.

Length 5 to 5½ mm.

NOTE—The figures in this paper are not drawn to a uniform scale. Wings and profiles were made with camera lucida.

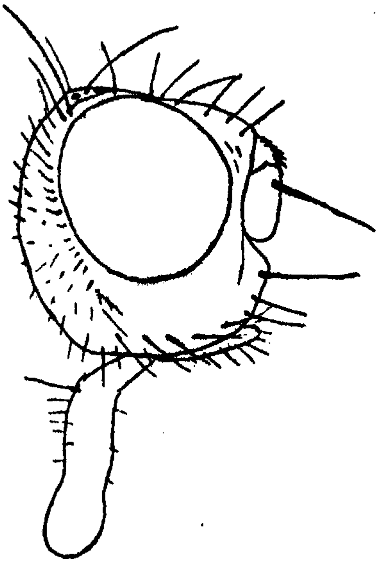

Fig. 1. *Fucellia maritima*, head in profile, male.

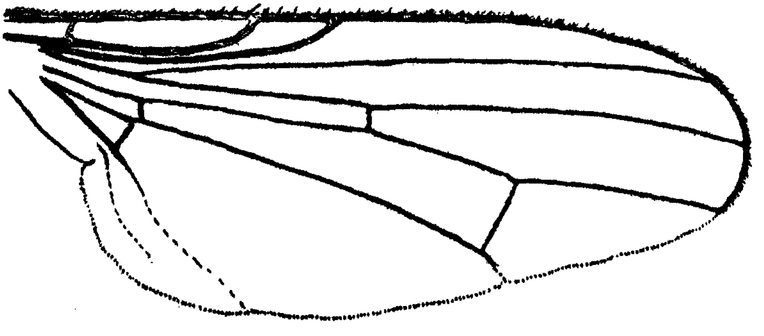

Fig. 2. *Fucellia maritima*, wing.

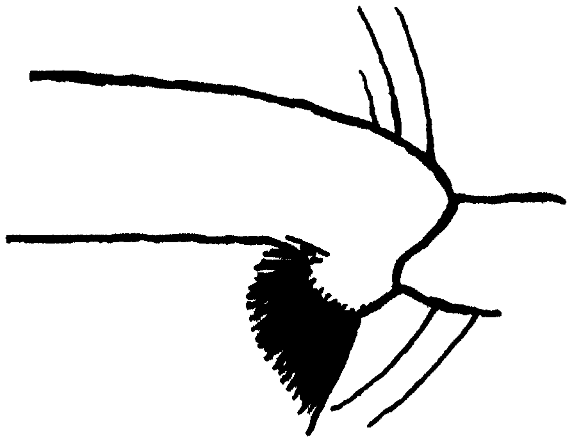

Fig. 3. *Fucellia maritima*, inner side of base of hind femur, male.

Eleven specimens, both sexes; one pair European without locality, determined as *fucorum* by Strobl many years ago; seven from New Bedford, Mass., determined as *fucorum* by Stein in 1897; one from Woods Hole, Mass.; one from Falls Church, Va., collected by Nathan Banks. I have determined and returned other Atlantic coast specimens of this common species, without making a note of the localities[3]. Mr. Malloch informs me that he has taken the species in southern Illinois.

2. **Fucellia fucorum** Fall.

(Fig. 4)

Fallen, Scatomyzides, 5, 1819 (Scatomyza).—Europe.

Meigen, Syst. Beschr., v, 253, 1826 (Scatophaga).

Curtis, Insects of Ross's Polar Exped., 1831, lxxx, oc. in Arctic America (Scatophaga).

Macquart, Hist. Nat. Dipt., ii, 395 (Scatophaga), 1835.

Haliday, Annals Nat. Hist., ii, 186 (Halithea), 1835.

[3] In the Osten Sacken material in the Museum of Comparative Zoology are a pair of *maritima* labeled "S. Barbara. O. Sacken," evidently indicating Santa Barbara, Cal., as the place at which they were collected. I had never seen the species from the Pacific coast, and in July, 1917, I improved an opportunity to collect closely for a couple of hours at Santa Barbara, endeavoring to confirm the occurrence of the species. I was entirely unsuccessful, and am obliged to conclude that the label is probably erroneous, as I think is also the one which would represent a female of *evermanni* as occurring on "Summit of Sierras." That such mistakes can easily occur when collections from several places stand unlabeled for a time is also illustrated by one of my 1917 specimens of *separata*, which I find labeled Jacumba Springs, Cal., about 100 miles inland from San Diego, where I collected the day before my arrival at the coast.

Zetterstedt, Ins. Lapp., 722, 723, 1838 (*Scatomyza fucorum* and *muscæformis*); Dipt. Scand., v, 1982 (Scatomyza) viii, 3293, 1849 (*Aricia brunnea*).

Stæger, Grœnl. Antliater. 366, 1845, oc. in Greenland (Scatophaga).

Schiner, Fauna Austr., ii, 15, 1864.

Boheman, Kong, Vet. Akad. Forhandl., xxii, 572 (*Scatomyza hyperborea*).

Meade, Ent. Mo. Mag., 1899, 219.

Lundbeck, Dipt. Grœnl., ii, 291, 1900, oc. in Greenland, with fig.

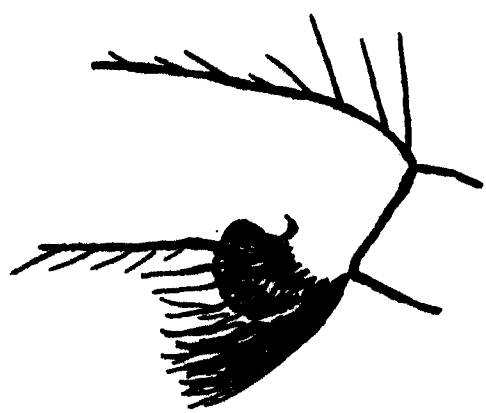

Fig. 4. *Fucellia fucorum*, inner side of base of hind femur, male.

Pandellé, Rev. Ent. France, xix, 270, 1900 (Chortophila).

Coquillett, Dipt. of Commander Islands (The Fur Seals, etc., 1899, pt. iv, p. 344), oc. on Commander Islands; Proc. Wash. Acad. Sci., ii, 1900, 453, oc. Sitka, Kukak Bay, Popof Island, and Saldovia, all in Alaska.

Stein, Wien. Ent. Zeit., xxix, 16, 1910, full discussion.—Seacoast of northern Europe, rare as far south as Germany; Bering Straits; St. Paul Island; Friday Harbor, Wash.

Johnson, Psyche, xvii, 76, 1910, not seen from east coast of North America; must be limited to the far north.

This species was not satisfactorily separated from *maritima* until Stein's 1910 paper, and the latter was generally named *fucorum* in collections until that time; hence we have several references in our literature to *fucorum* occurring in Georgia, Porto Rico, New Jersey, and Florida, now believed to refer to *maritima*.

Fucorum possesses the generic characters given above for *maritima*, as well as most of the specific characters of that species. The general color is darker; the palpi and legs are wholly black and the front dark brown; front wider, almost half the head; parafacials wider, and with a changeable dark pollinose spot beside the base of antenna; vibrissæ higher above lower edge of head; bucca wider, about ⅓ the eye-height; middle tibia with a seta on inner front side, one or two on outer front, and two on outer hind side; middle femur with an even row of about 12 short bristles along upper front side; hind femur of male with a basal meso-ventral protuberance which is slightly enlarged at tip and bears very minute spines; just laterad of it is a tuft of larger stout hairs or small bristles. Hypopygium small; a male from Douglas, Alaska, shows the parts somewhat protruded; in this the second segment of the hypopygium has a deep median groove behind, dividing it into two lobes; the lateral lobe of the fifth sternite is angular and slightly notched mesially near its base, the median emargination of the sternite yellow, with a small yellow point in the center. In a Friday Harbor specimen the emargination and point are brown, the rest retracted.

Length 4.3 to 6 mm.

Forty-five specimens, both sexes; eight from Douglas, Alaska (Eldred Jenne); 27 from Vashon Island, Wash. (Melander); one from Seattle, Wash. (O. B. Johnson); one from Tokeland, Wash. (R. W. Doane); and eight from Friday Harbor, Wash. (Aldrich).

I have also seen a long series collected at Kodiak Island and Katmai, Alaska, by Professor Hine in 1917.

3. **Fucellia costalis** Stein

(Fig. 5)

Stein, Wiener Ent. Zeitung, xxix, 21, 1910.—Monterey, Cal.

Cole, First Report Laguna Marine Laboratory, p. 156, 1912. oc. at Laguna, Cal., and notes.

Male: Front black with thin brown pollen, as wide at vertex as one eye, narrower toward antennæ; two verticals, one ocellar, two small behind ocelli, three frontals curving outwardly, five smaller below curving to the middle; lower part of the narrow parafrontal with a few small hairs in a row; parafacial and bucca silvery pollinose, the former ¾ as wide as the length of the third antennal joint, the latter 2/5 as high as the eye and bearing one row of bristles at lower edge; antennæ black, third joint 1⅓ times the second and rather tapering, arista thickened on basal fourth; vibrissæ rather high above lower edge of head; palpi black; proboscis short, black, fleshy; back of head with numerous black hairs, the occiput however conspicuously bare.

Thorax as in *maritima* except that the acrostichals are small and irregular, some outside the two rows, and the dorsal surface is quite generally covered with small hairs among the bristles, not present in *maritima;* prescutellars distinct; prothoracic three, mesopleura hairy ex-

cept behind the spiracle, several bristles below the latter; calypters white, the upper edge of the hind one projecting a little; lower part of sternopleura with coarse, abundant bristles.

Abdomen tessellated, with rather distinct median black stripe; first segment almost as long as the next two; a fifth segment visible dorsally as a narrow edge before the hypopygium. Hypopygium of moderate size, the first segment densely set with straight spiny bristles; fifth sternite with a long brown lobe each side of the excision.

Legs entirely black; front tibia with one seta in front, one or two slender on hind side; middle tibia with one on outer front, two on outer hind side; middle femur with the hind lower row becoming short and comblike near tip; hind tibia with three on hind (extensor), three on outer hind, four on outer front side; hind basitarsus with a conspicuous stout spine on lower surface near base; front and middle coxæ very bristly; pulvilli all enlarged and elongated.

Wing subhyaline; beginning at apex of auxiliary the costa bears seven or eight stout setæ, much larger than in the other species, diminishing toward the end of the series (fig. 6).

Length 6.8 to 7 mm.

Female: Front wider, 1⅓ times as wide as one eye; width of parafacial equal to length of third antennal joint; bucca fully half the eye-height; acr rather distinctly four-rowed; anterior tibia with one in front and two

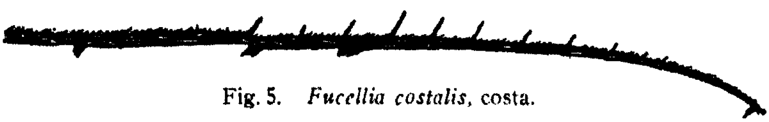

Fig. 5. *Fucellia costalis*, costa.

stout on outer hind side; middle femur with only hairs in place of comb; mid tibia with one or two small on inner front side; one large on outer front, two or three irregularly placed on outer hind; hind basitarsus as in male; pulvilli not enlarged.

Length 7 to 7.8 mm.

Twenty-three specimens of both sexes; two from Laguna, Cal. (Cole); 20 from San Diego, Cal., June 29, 1917; and one from Santa Barbara, Cal., July 6, 1917.

The largest species of the genus. Cole (loc. cit.) says of it: "This species is quite common on decaying kelp. They are large, quick flies. They seem to be at least partially predaceous in habit, as I have seen them pounce upon weakened sandhoppers and by their numbers soon overcome them."

4. **Fucellia pictipennis** Beck.

Becker, Meddel. om Grœnland, xxix, appendix, 411.—East Greenland.

Neilsen, ibid, xliii, 32, oc. in N. E. Greenland, lat. 76° 46′.

Stein, Wien. Ent. Zeit., xxix, 26, types redesc.—Hecla Havn, East Greenland.

Johnson, Psyche, xvii, 76, note.

Male: General color deep black, with thin light-gray pollen; frontals five, the two upper turning out, the rest inward; antennæ notably large and broad, reaching the oral margin, which is not much above lower edge of head; bucca almost as high as the eye, bare except the usual row below; back of head bulging, nearly bare; palpi black, long and broad; proboscis short; one pair cruciate bristles on front, one pair ocellars and two small behind; arista short, thick at base.

Thorax with two or three pairs of ant acr, no hairs among them; chætotaxy as in *maritima* (prealar not noted); stpl 2-2, but the lower ones hardly more than hairs, especially the hind one; calypter small with dark rim but pale fringe, hind calypter very small; halteres sordid dark yellow, almost brown.

Abdomen showing five segments above, the first elongated, the fifth very narrow; hypopygium not very large; fifth sternite black, the lobes long, black, with a few long bristles on outer edge.

Legs entirely black; front tibia with one seta on front (extensor) and one on outer hind side; middle tibia with two on outer front, two on outer hind, and one on inner hind side; hind tibia with the usual three erect long ones on hind (extensor), the outer hind with two near middle and some coarse hairs above and below; hind femora without a protuberance but with a row of 12 bristles below, beginning at second third.

Wing whitish, apical half blackened, less so behind; first vein thick and black at apex, crossveins black, costa with almost imperceptible setules.

Female: Palpi decidedly broadened toward tip, somewhat as in *Lispa ulignosa* Fall., but black.

Length 3 mm.

Eleven specimens, both sexes, Bernard Harbor, Northwest Territory, Canada, collected by the Canadian Arctic Expedition. I saw this material in the Illinois State Laboratory of Natural History, where it had been identified by Mr. Malloch, who called my attention to it. It is to be deposited in the Canadian National Collection in Ottawa. A single specimen in the Carnegie Museum, Pittsburgh, is labeled, "82° n. Lat. On the Beach at n. e. extremity of L. Hazen in the interior of Grant Land. June 7, 1908. Peary Arctic Exped." It was collected by J. W. Goodsell, surgeon, along with two specimens of *Phormia terræ-novæ* RD., which bear the same label, and are also in the Carnegie Museum. This record is probably as far north as any fly has been collected. I have mentioned it in Psyche, xxv, 33.

5. **Fucellia rufitibia** Stein.

(Fig. 6)

Stein, Wien. Ent. Zeit., xxix, 25, 1910.—Pacific Grove, Cal.

Cole, First Report Laguna Marine Laboratory, 1912, p. 156, note and full-page figure.—Laguna, Cal.

This Pacific species is very closely similar to *maritima* of the Atlantic coast; it is easily separated in the male sex, but pretty close attention is required to distinguish the females, except by the locality labels.

Male: Compared with *maritima*, the male of *rufitibia* has black or blackish palpi instead of yellow; the bucca is more than half the eye-height; the hind femur has no protuberance on the under inner side at base; the middle femur has a long bristle below at middle and one nearer base, whereas there is none in *maritima;* the second, third and fourth abdominal segments are shortened (retracted) so much that they are together usually not much longer than the first segment; and the hypopygium is very much larger and more globose. Among these characters, the

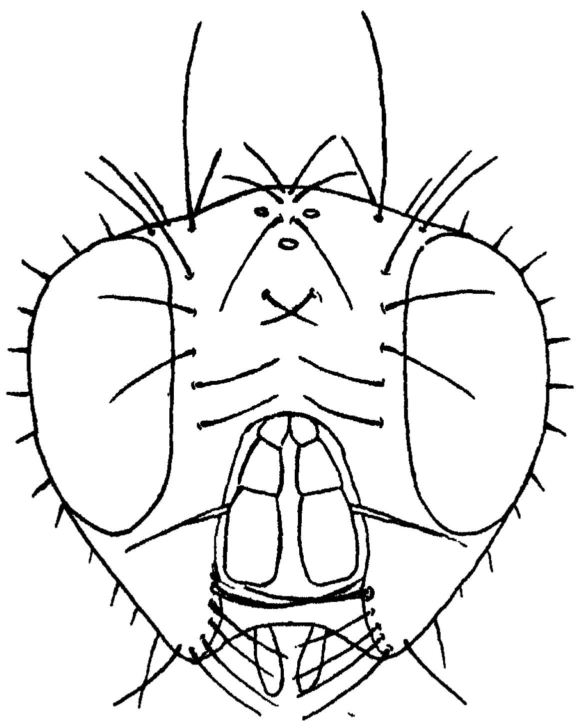

Fig. 6. *Fucellia rufitibia*, front view of head in female.

color of the palpi and the absence of the hind femoral tubercle are ample to distinguish the species. The forceps are difficult to draw out, but are found to be very slender and nearly straight, shining black, more like needles than hooks.

Female: This sex is distinguished from *maritima* by the palpi, bucca and middle femur, being as in the male; the setules of the costa are longer than in the Atlantic species, and this is also true in the male.

Length 3 to 4 mm., noticeably less than in *maritima.*

Forty-five specimens, both sexes; Pacific Grove, Santa Barbara, Laguna, Santa Monica, Long Beach and San Diego, Cal.;

two Laguna specimens are from F. R. Cole, and two Santa Barbara are marked "Dyar", but I have had them many years. I collected all the rest, including some at Santa Barbara. Dates of collection are of almost no significance.

The species occurs in swarms on the castup seaweed of the California seashore; I have had several thousands in my net at once. It is the most abundant of the shore flies.

6. Fucellia separata Stein.

Stein, Wien. Ent. Zeit., xxix, 24, 1910.—Monterey, Cal., and Seattle, Wash.

Male and female: General ground color dark brown, with gray-brown pollen. Front over one-third the width of the head, yellow above antennæ, bristles as in *maritima;* antennæ black, small, third joint only a little longer than second, arista short, a little thickened on basal third; parafacial yellow-pollinose, narrow but very short on account of the peculiar shape of the eye, which has its longest diameter almost lengthwise of the insect and is short vertically, leaving a broad, yellow-pollinose bucca as high as it is; vibrissæ high above lower edge of head; palpi black, sometimes dark yellow at base; proboscis small, black; back of head bulging and nearly bare.

Thorax brown, opaque, a lighter pollinose streak from the inner part of humerus back to root of wing, and a pale spot on side just below humerus; chætotaxy as in *maritima*, but with a few small, distinct hairs bordering the humerus and suture and behind the latter, and stpl only 1-1; calypters pale yellow, rim and fringe concolorous; halteres yellow.

Abdomen a little tessellated, in the female with no special characters; in the male the hypopygium is large, the fourth segment wide and declivous, the fourth sternite strikingly large, prominent but bare; first segment of hypopygium dull brown, with numerous spiny hairs on hind part; second segment concolorous, concave in profile to a bifurcated hump just before the anus; forceps dark yellow, wide, flat, and arched toward the median line.

Front tibia with one seta on front, generally one small on outer hind side; middle tibia with one on outer front, one on outer hind, and in the female there are also one or two each on inner front and inner hind, which are generally absent in male; hind tibia with two on hind, two on outer hind, three on outer front; middle femur in male with a row of small bristles on lower front edge, showing but slightly in female; hind femora plain in male, with row of bristles on outer upper edge in both sexes, and one smaller on lower outer edge in male, which is but little developed in female.

Wing subhyaline, costal spine rather distinct, other costal setules present but small.

Length 4 to 4½ mm.

One hundred specimens, both sexes; 65 collected by myself at Pacific Grove, Santa Barbara, Long Beach, and San Diego, Cal., and 35 by Professor Melander at Ilwaco, Wash., in 1917.

This is the second species in abundance on the California coast, ranking next to *rufitibia.*

7. **Fucellia rejecta**, new species

Female: Black in ground color, but with legs, wing veins, and most of the head yellow. Front almost half as wide as head, decidedly prominent above antennæ, bristles as in *maritima;* parafrontals brown above, yellow below their middle; frontal stripe reddish, with an interrupted blackish crescent anteriorly, beyond which it is yellow to the antennæ; parafacials and bucca yellow, with yellowish pollen, the former wider than usual, the latter almost as wide as eye-height; eye almost perfectly round; antennæ dark yellow, third joint except the base dark brown, arista brown, thickened almost halfway, pale in middle; palpi yellow, proboscis black; back of head black in ground color above, yellow below, bulging, with few hairs, those of metacephalon long.

Thorax with same chætotaxy as *maritima*, but the post dc might be counted as four, since the coarse hair behind the third is here fully half as long as the latter; between and above the front coxæ is a keystone-shaped sclerite with a notch above, into which fits a rather striking, small shining red sclerite; calypters white, rim and fringe concolorous; halteres yellow.

Abdomen slightly tessellated, with an indefinite median dark stripe which disappears at some angles of view; fourth segment yellow on apical third.

Legs yellow, including tarsi as much as halfway, but the latter are darkened by the usual small hairs; front and hind femora slightly infuscated at base; front coxæ yellowish, the others black in ground color; front tibia with one strong seta on front and one on outer hind side; middle tibia with one (large) on outer front, 3 irregularly placed on outer hind; hind tibia with three on hind (the third nearly one-third as long as the tibia), four on outer hind, and two on outer front; middle femur with four scattered bristles on lower hind edge; hind femur with a row above and 6 or 7 below on outer side.

Wings hyaline, veins yellow, third more brown; costal spines small, the usual setules of the genus almost imperceptible.

Length 7 mm.

One female, Ocean Beach, a suburb of San Diego, Cal., June 28, 1917. Type in U. S. National Museum.

I do not hesitate to describe this well-marked species from a single specimen, as it is not rare where the type was obtained. I saw several specimens, distinguishing them readily at several feet by their pale color; but on account of their activity and wildness, I succeeded in capturing but one in the time at my disposal. It is not unlikely that the males have somewhat darker femora, judging from the slight infuscation at the base of the front and hind femora in the type.

The nearest ally of *rejecta* is perhaps *funifera* Stein (W. E. Z., xxix, 22) of Chile and Peru; it has yellow legs, but the parafacials are hairy, and the scutellum has hairs on the disk and lacks the usual pair of discals. *Funifera* is the only species of the genus known from the west American coast south of San Diego.

8. **Fucellia antennata** Stein.

(Fig. 7)

Stein, Wiener Ent. Zeit., xxix, 23, 1910.—Sitka, St. Paul Island, and Karluk, Alaska.

Male and female: Black with opaque gray pollen, which has a glaucous or bluish cast. Front in male, .483, in female .515 of head width (one of each sex); frontal stripe brown, with brown pollen; bristles of head as in *maritima*, but only two lower, incurved frontals; antennæ black, the third joint distinctly longer and wider than in other species, reaching almost to the vibrissæ; parafacials rather narrow, bucca almost as high as the eye, which is nearly round; facial ridges yellowish, pollen of bucca smooth and gray; palpi black, ordinary; proboscis black, small; back of head bulging, with scattering hair.

Thorax with same chætotaxy as in *maritima*, except that the scutellum has only a single very distinct row of hairs well down on the edge; prealar distinct, but only a third as long as supraalar; behind the suture are only a few hairs laterally; the pale spot below the humerus is indistinct; lower stpls very small; calypters pale, rim and rather heavy fringe concolorous; halteres yellow.

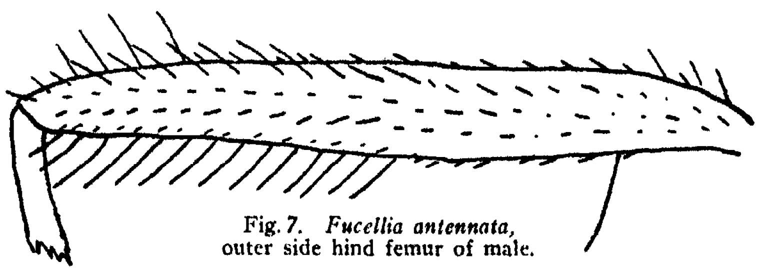

Fig. 7. *Fucellia antennata*, outer side hind femur of male.

Abdomen hardly tessellated, of ordinary structure; in the female the fourth segment longer than the preceding; male hypopygium of moderate size, black; fifth sternite rather erect, with large lateral lobes forming more than half a circle, within them a deep cavity, in the single specimen; second and third tergites together in male longer than first, fifth tergite not visible.

Legs black, trochanters reddish; front tibia with one seta in front; middle tibia with one on outer front, one on outer hind, on inner front the male has one, the female two; hind tibia with three behind, four on outer hind, female has two on outer front which are absent in male; middle femur with erect row of about 7 small slender bristles on hind side below, stopping just beyond middle, the same in both sexes; hind femur with usual row above in both sexes, in the male a very characteristic row of about 13 on lower outer edge, beginning before the middle, very straight and even and close together; the last in the female are fewer, only about 7, and ordinary in appearance.

Wing hyaline, costal spines and setules very minute.

Length, of male 3½ mm.; of female, 5 mm.

Twenty specimens, both sexes; five from Douglas, Alaska, August, 1901 (Eldred Jenne); one from Katmai, Alaska, in 1917 (Hine); 13 from Ilwaco, Wash., in May and July, 1917 (Melander); and one from Tacoma, Wash.

9. Fucellia evermanni, new species

(Fig. 8)

Male: Opaque, gray-brown species; front .463 of head-width (in the type), rather short and bulging; bristles of head as in *maritima*, except that there is uniformly a second pair of cruciate frontals, slightly smaller than the usual ones and standing about twice as far apart below them; antennæ small, black, second joint reddish on front side, third only as long as second, arista short, shining black on the enlarged basal fifth; parafacials opaque gray, front edge and down along facial ridge reddish; bucca opaque gray, almost as high as the eye, which is small, roundish, slightly elongated obliquely; palpi dark yellow, their tips a little infuscated; pro-

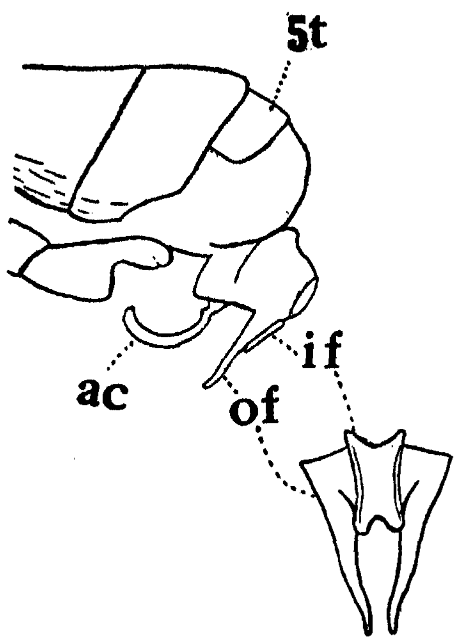

Fig. 8. *Fucellia evermanni*, side view of hinder part of male abdomen with genitalia drawn out, together with posterior view of the forceps.
5t, fifth tergite.
if, inner forceps.
of, outer forceps.
ac, anterior clasper. (Penis and posterior claspers not shown.)

boscis short, black; back of head very bulging, with rather coarse and numerous black hairs.

Thorax opaque gray with slight traces of brown pollinose spots above; chætotaxy as in *maritima*, except as follows: in the ant dc rows and laterad of them are some noticeable hairs, and there are hairs on the disk of the scutellum, as well as rather plentifully behind the suture; prealar and lower hind stpl absent. Calypters white with yellow rim and long, whitish fringe; halteres pure yellow.

Abdomen smooth, sub-opaque, dark gray, with slightly silky surface, rather long and with parallel sides; second, third, and fourth segments of equal length, each more than half the first; the hairs on hind edge are longer and more numerous on each succeeding segment, very striking on the last, yet so slender as hardly to be called bristles; fifth tergite conspicuous, half as wide in middle as the preceding, unsymmetrical in shape, its left end shortened and exposed, the right passing out of sight under the preceding segment; its hind part bearing long, rather appressed hair; first segment of hypopygium rather large, with the same hair; second segment large but more or less folded in out of sight, its hind part bearing an unsymmetrical black hump or protuberance to the right of the middle; a fringe of black hairs around the nearly circular anal space; the inner forceps forming an oblong plate with only short projecting anterior outer angles; outer forceps shining yellow to brown, very slender and nearly straight, far apart at base but approaching apically, the tips slightly turned up; anterior claspers a little larger than the outer forceps, shining yellow, strongly curved forward, widened near apex; fifth sternite broadly shining black in middle, the sides opaque, both parts hairy, lobes with longer hair; fourth sternite large, prominent, hairy.

Legs entirely black; front tibia with one bristle in front; middle tibia with two on outer front, two on outer hind, one on inner hind side; hind tibia with three behind (the middle one long and tapering), three on outer hind, four on outer front; middle femur with row of small bristles on lower front edge and another a little larger but still small on lower hind edge; outer side of hind femur with the usual row above, and a row of about a dozen below, beginning near base. Claws large, pulvilli hardly enlarged. Hind basitarsus without spine below.

Wings uniformly subinfuscated, veins heavy and dark; costa broken at tip of first vein, which is pale for a short distance; first vein almost white for a section near its middle, thence to apex heavy and black; some indistinct pale markings around the basal crossveins; costal spines very minute, no setules before or beyond them.

Female: Front .461 of head-width (in allotype); ant acr in the middle of the series coarser than in male; middle tibia with two on inner front, none on inner hind, two on outer front, two on outer hind; middle femur with the bristles on lower front edge larger than in male, second segment of abdomen shortest, fourth narrowing almost to a point, and bearing at hind edge both above and below a close row of stout, appressed bristles, about 16 above and 12 below; other abdominal bristles inconspicuous; lateral and lower surface of abdominal tergites and whole of sternites covered with short, erect, spiny hairs of an unusual character. The rest as in male.

Length 5½ to 6½ mm.

Twelve males and four females, collected by Dr. Barton Warren Evermann, Director of the Museum of the California Academy of Sciences, for whom the species is named, on the Farallon Islands off the Golden Gate, on July 6, 1917. "This kelp-fly is excessively abundant on the Farallon Islands. On July 6 and again on August 6, 1917, when I visited Southeast Farallon Island, these flies simply swarmed by hundreds of millions on and about the bird rookeries, particularly on the areas where Brandt's cormorants were nesting. One could not move about these rookeries without being constantly covered and surrounded by myriads of these pestiferous little flies." (Evermann.) One female from the Museum of Comparative

Zoology, Cambridge, Mass., bearing the label, "Summit Sierra Nevada, July 17. O. Sack," in Osten Sacken's handwriting. This locality, so far from the seashore and elevated about 7000 feet above it, seems almost incredible for a *Fucellia;* it agrees, however, with Osten Sacken's statement on the first page of his "Western Diptera", that he spent two weeks in July, 1876, in collecting about Webber Lake in the Sierras, this lake being near the summit north of the Southern Pacific railroad. Whether he did not accidentally incorporate a seacoast specimen with his summit material is the question.

Type and paratypes in Museum of California Academy of Sciences; paratypes in U. S. National Museum.

See notes on relationship under *Fucellia bicruciata* Stein.

10. **Fucellia bicruciata** Stein.

Stein, Wien. Ent. Zeit., xxix, 20.—Miednaja, Bering Straits.

"Front very broad, above the antennæ at least twice as broad as one eye at the same level, with two pairs of cruciate bristles, one pair close behind the other, equally strong and equally far apart, in front of which is still a third pair which stand farther apart. The projecting part of the front is in profile completely convex. Bucca very wide, fully equal to the eye-height; back of the head very bulging. Antennæ shorter than the face, third joint hardly longer than the reddish second, arista thickened on the basal fourth. Palpi black and bristly, quite stout. Thorax colored and marked as in *fucorum*, acr in two rows, anteriorly with small, scattered hairs between them; prealar entirely wanting, stpl two in front, one behind, below the latter no trace of a small bristle. Scutellum on its upper surface more bristly than in the other species. Abdomen of the usual color, apparently with a median narrow dark stripe. Legs black, claws somewhat elongated, pulvilli short. Front tibia without a bristle on the side away from the body, only ciliated with fine hairs; middle tibia with two on outer front, one on outer hind, three on inner front, the last on the apical half, short but strong; hind femur on the lower outer edge with about 8 bristles in the whole length, hind tibia with the usual bristles. Wings dirty yellowish-gray, the base with whitish spots, all the veins strong, especially the last third of the first vein, which is whitish just before this part. Costal spine very small, no setules visible, both crossveins feebly infuscated. Calypters very small, whitish with yellowish border, halteres yellow.

"Length about 8 mm.

"The two specimens before me, which seem to be females, are from Mr. Becker's collection and were taken at Miednaja on Bering Straits."

The above is a translation of the entire description. I have seen no specimens agreeing with it in regard to the cruciate bristles. It may be inferred that the type specimens were not in good condition, as Stein was not sure of the sex. In many details *evermanni* agrees, and must be a near relative, but has so many strong characters not mentioned by Stein that it would

be assuming far too much to identify it as *bicruciata,* to say nothing of the thousands of miles of coast line between the Farallon Islands and Bering Straits which has so far yielded nothing to connect the species.

Whether Miednaja is on the Asiatic or the North American side of the Straits I have been unable to find out.

11. **Fucellia ariciiformis** Holmg.

(Fig. 9)

Holmgren, Kongl. Ventesk. Förhandl., 1872, 103 (Scatophaga).—North Greenland.

Lundbeck, Dipt. Grœnl., ii, 292, fig. (Vidensk. Medd.,

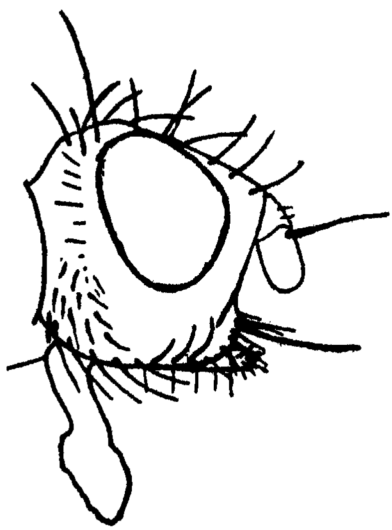

Fig. 9. *Fucellia ariciiformis,* head in profile, male.

1900).—Several places on Greenland coast, bred from seaweed.

Stein, Wien. Ent. Zeit., xxix, 19, 1910, redesc. from Lundbeck's material; Arch. f. Naturgesch., lxxix, 44, female in table, 1913.

Johnson, Psyche, xvii, 77, 1910.

Male: Opaque dark gray, with three indistinct brown thoracic stripes. Front prominent, .451 of head-width in the described male; face receding more than usual; bristles of head as in *maritima* but generally longer, especially the two pairs behind the ocelli; parafacials and bucca dark gray, the latter fully half as high as the eye, with long bristles below; antennæ

black, standing out prominently, second joint about half as long as third, arista black, penultimate segment distinct, thickened for nearly a third of last segment, beyond with minute, microscopic pubescence; palpi black, with long bristles below; proboscis short, black; back of head bulging, with a few rather long hairs.

Thorax opaque dark gray, with an indistinct brown stripe on the acr, one each side on the dc, and behind the suture a short one on the intraalars; chætotaxy as in *maritima*, but there are a few quite long hairs in the dc rows, about the humeri, and laterally behind the suture; the hind postalar is notably long; calypters dirty, whitish, rim and fringe indistinctly brownish; halteres rather dark yellow.

Abdomen rather long, with parallel sides; second, third and fourth segments subequal, not much shorter than the first; a distinct fifth tergite shows about ¼ the length of the preceding one; hypopygium rather small, its first segment with numerous smallish bristles directed backward, second much imbedded, when viewed from behind showing a decided notch posterior to the anal area; fifth sternite not in good condition in the described specimen, but with long hairs on the sides; the preceding sternites inconspicuous.

Legs wholly black, with long bristles; front tibia with one in front and one on outer hind side; middle tibia with one on outer front, two on inner front, one on outer hind, and two on inner hind but not far out of line with the last preceding; hind tibia with three behind, four on outer hind and four on outer front side. Middle femur with about four long scattered bristles on lower front edge and a row on lower hind which are long near the middle, but shorter and slanting toward tip; hind femur with the usual upper outer row, and a lower outer one of about 8 long ones, beginning near base; hind femur at base below with a tuft of small spines situated upon a slight elevation; hind basitarsus with a spine below. Pulvilli and claws small.

Wings slightly and uniformly infuscated; veins blackish, crossveins not bordered; spines and setules distinct but small.

Female: Parafacial and bucca wider (or eye smaller); bucca over half the eye-height, with very long bristles below; the specimen has four decussate lower frontals, instead of three as in male; abdomen without any striking bristles, the second and third segments shorter than the first and fourth; tibial bristles same as in male; middle and hind femora as in male, except that the latter lacks the spinous elevation on the base below.

Length 4½ to 5 mm.

One male, one female. St. Paul Island, Bering Sea, August 16, 1915, in the collection of the U. S. Biological Survey; the Survey has a series taken at the same time and place which I have not seen; they were determined by Mr. Malloch. I have seen a series of 25 specimens, taken by the Canadian Arctic Expedition at Bernard Harbor, Northwest Territory, Canada; these are the property of the Canadian National Collection, and were also determined by Mr. Malloch.

Stein places some stress upon the bloodred color of the halteres in both sexes, but I think it a variable character in dried specimens, and it does not occur in what I have seen, although they run to *ariciiformis* in both sexes in Stein's tables. Existing descriptions say very little about the chætotaxy.

12. **Fucellia æstuum**, new species

Male: Very much like *maritima*, but the tibiæ black and the hind femora plain. Front .426 of head-width (one specimen), brown, very little paler at front edge; bristles as in *maritima;* antennæ black, third joint less than twice the second, arista bare, enlarged for a third its length; parafacials and bucca gray, the former rather narrow and with a changeable spot opposite antenna, the latter half the eye-height; palpi dark yellow, the apical third blackish; proboscis black, small; back of head only moderately bulging.

Thorax unicolorous dark gray above, a shade lighter on sides; ant acr three stout pairs, no small scattered hairs before the suture, and only four to six behind it; prealar distinct but less than half as long as the bristle behind it; rest of thoracic characters as in *maritima*.

Abdomen with thin brown, changeable pollen, giving a tessellated effect, in some lights showing a broad median dark stripe; bristles inconspicuous; fifth segment indistinctly marked off from the first of the hypopygium, which is small and bears numerous bristles behind; second of hypopygium small, subshining black, with only small hairs; fifth sternite yellowish brown, suberect, forming with its concolorous lateral lobes a raised rim open behind, the central space hollow to some depth (probably not so in all specimens, this is a single case); the lateral lobes bear only fine hair.

Legs black; front tibia with one bristle on front side; middle tibia with one on outer front, two or three on outer hind; hind tibia with three on hind, four on outer hind, and on outer front side with a row of about 8, smaller above; hind basitarsus with spine below; middle femur with a few scattering bristles below on both front and hind edges, longer behind; hind femur plain, its outer side bearing the usual row of bristles above, while below it has a row of about 7, beginning before the middle.

Wings subhyaline, crossveins not infuscated, costal spines and setules small but visible.

Female: Same as male except as to genital segments. The palpi being red at base is a good character to separate these females from those of *fucorum, ariciiformis, antennata,* and apparently *hinei*.

Length 4 to 4½ mm.

Fifty specimens, both sexes: 46 (including type) from Ilwaco, Wash., July, 1917 (Melander); two Vancouver, B. C., Aug. 8, 1917 (Melander); one Tokeland, Wash. (Doane), and one Pender Island, B. C. (Aldrich).

Type and paratypes in California Academy of Sciences; sets of paratypes in the United States National Museum, the Canadian National Collection, in Professor Melander's collection, and in that of the writer.

13. **Fucellia hinei**, new species

(Fig. 10)

Entirely black, slender, with globose head, apical half of wing anteriorly with distinct but ill-defined brown tinge.

Male: Front .486 of head width (average of two—.500 and .471); frontals 7, upper 3 inclined outwardly, lower 4 mesially; one large pair

cruciate in the front; ocellars large, with two smaller pairs behind them; front, face, antennæ and palpi entirely black; parafacials at narrowest as wide as third antennal joint, the latter less than twice as long as second joint; bucca over ½ the eye-height; back of head greatly protuberant, with black hairs.

Thorax thinly pollinose, the mesonotum not showing the normal pollen in either specimen; pleuræ with faint white pollen, which becomes dense in a spot just below the humerus at the side; chætotaxy as given for *maritima*, except that the lower hind sternopleural is absent and there are several of different sizes at the anterior end of msn and above front coxa; calypters and fringe nearly white, rim more yellowish; halteres dark yellow, subinfuscated.

Abdomen narrow, black, with thin, dark tessellation; second, third and fourth segments subequal, first longer; hypopygium small and much retracted, wholly black; fifth sternite wholly black, its free and elevated lateral lobes black, infolded.

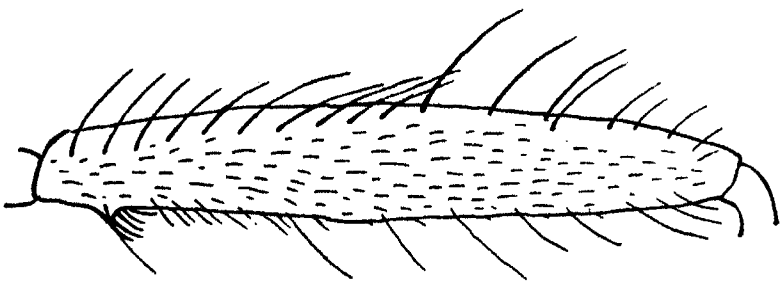

Fig. 10. *Fucellia hinei*, outer side hind femur of male.

Legs wholly black; front tibia with one bristle in front at second third and one on outer side at middle; middle tibia with 2 on outer front, 2 on inner front, 3 on outer hind (of which the upper and lower are almost on inner hind); hind tibia with 3 on hind, 4 on outer hind, 5 on outer front; hind basitarsus with smallish spine below; middle femur with a row of 15 on the whole length of the lower hind edge, and nearly a dozen on lower front edge, of which the stoutest are before the middle; hind femur with the usual upper and lower row on outer side, and at base below with a tuft of four to six small spines, which are variable and sometimes stand on a distinct elevation.

Wings tinged with gray, and marked as stated with a vague brown spot beyond the middle on anterior half; costal spines and setules rather smaller than usual.

Length 5 mm.

Two males, Kodiak Island, Alaska. Collected by Prof. Jas. S. Hine, after whom the species is named. Type and paratype in Professor Hine's collection.

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VI

THE GARTER-SNAKES OF WESTERN NORTH AMERICA

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TABLE OF CONTENTS

October 18, 1918

INTRODUCTORY REMARKS

A number of years ago, in preparing an account of the reptiles of the Pacific Coast, it became necessary to study with great care the various species and races of garter-snakes of this region. Cope had described and recognized some 17 kinds of garter-snakes from these far-western states, and had left the whole subject in most puzzling confusion. Critical study[1] of more than 300 fresh alcoholic specimens, in conjunction with the material in the National Museum, including most of the type specimens, showed that many of the forms recognized by Cope were based solely upon individual variations, and as a result of that study the species and races which seemed worthy of recognition by name were reduced to seven.

A. E. Brown, in 1901 and 1903, adopted those conclusions except that he held that Cope's race *vidua* was identical with *T. leptocephala* instead of with *T. elegans,* it having been based upon the type specimens of Kennicott's *Eutænia atrata.*

Some years later, Ruthven published an exhaustive account of the garter-snakes. Unfortunately, much of the available material from the Pacific states was not included in his studies. It is probable that more abundant material would have changed his views in several respects as to the relationship and distribution of our garter-snakes. Largely because Ruthven's views and our own have not been in complete accord, we have undertaken to study anew the garter-snakes found west of the Rocky Mountains, and for this purpose have gathered together about 1700 of these snakes from this region. Most of these are the property of the Academy, but several hundred have been borrowed for study from the collections of Stanford University and the University of California. For this privilege we are indebted to Professors Charles H. Gilbert and John O. Snyder of Stanford and Dr. Joseph Grinnell of the University of California. The snakes in the collection of the University of California are distinguished by the letter C prefixed to their numbers; those from Stanford University, by the letter S. When no letter is attached to its number the specimen is in the collection of the Academy. In this renewed study of these snakes Mr. Slevin has assisted in many ways and especially is responsible for the counts of the scales of all the specimens.

[1] The Reptiles of the Pacific Coast and Great Basin, by John Van Denburgh. Occasional Papers Cal. Acad. Sci., Vol. V, pp. 1-236, 1897.

The seven kinds of garter-snakes recognized in the earlier study are here increased, through the recognition of additional subspecies and the inclusion of the snakes of Arizona, to 14 species and subspecies. As regards the original area, however, the increase is three subspecies.

Excepting certain species from Arizona, all of our garter-snakes may be regarded as belonging to two groups or lines of descent. These may be spoken of as the *sirtalis* and *elegans* groups. The latter is much the larger. We are unable to follow Ruthven in placing in it *Thamnophis angustirostris,* but otherwise include about the same forms.

LIST OF SPECIES AND SUBSPECIES

The present study concerns itself with the following species and subspecies:

1. Thamnophis sirtalis parietalis
2. Thamnophis sirtalis concinnus
3. Thamnophis sirtalis infernalis
4. Thamnophis eques
5. Thamnophis ordinoides ordinoides
6. Thamnophis ordinoides atratus
7. Thamnophis ordinoides elegans
8. Thamnophis ordinoides couchii
9. Thamnophis ordinoides biscutatus
10. Thamnophis ordinoides vagrans
11. Thamnophis ordinoides hammondii
12. Thamnophis marcianus
13. Thamnophis megalops
14. Thamnophis angustirostris

These snakes usually may be distinguished by the characters set forth in the following "key," but it often will be necessary to have series of specimens, since individual variation is so great that a single specimen may not show the normal characters and may be referred to the wrong section. Thus, a specimen of *T. s. concinnus* having eight supralabials might be referred to *T. eques,* or one of *T. o. atratus* with seven labials might cause confusion, whereas a series of three or four specimens would immediately clear up the matter by showing these counts to be abnormal ones.

KEY TO THE GARTER-SNAKES OF WESTERN NORTH AMERICA

a.—Lateral light stripe anteriorly not involving scales of the fourth row.
b.—Lateral stripe anteriorly upon scales of the second and third rows.
c.—Supralabials normally seven.
d.—Eye large, posterior genials much longer than anterior, infralabials usually ten, scale-rows 19—19—17.
e.—Gastrosteges (146 to 170) and urosteges (66 to 95) average fewer in number (156-166 and 76 to 85).
f.—Coloration lighter, with broader light lines.
T. sirtalis parietalis ....p. 190
f².—Coloration usually darker both above and below, lines often narrower.
T. sirtalis concinnus ....p. 192
e².—Gastrosteges (156 to 177) and urosteges (74 to 97) average more numerous (163 to 169 and 83 to 90), coloration lighter than in f².
T. sirtalis infernalis..........p. 198
d².—Eye much smaller, posterior genials about equal to anterior, infralabials usually fewer than ten, scale-rows usually 17—17—15.
T. ordinoides ordinoides.....p. 215
c².—Supralabials normally eight.
dd.—Scales usually in not more than 19 rows.
ee.—Gastrosteges average more than 160, eye large, posterior genials longer.
T. eques......................p. 204
ee².—Gastrosteges average fewer than 160, eye small, genials subequal.
T. ordinoides atratus.........p. 224
dd².—Scale usually in more than 19 rows.
eee.—Dorsal line present over most of body.
ff.—Dorsal line very distinct with sharply defined borders not invaded by dorsal spots, little dark pigmentation on gastrosteges.
T. ordinoides elegans........p. 235
ff².—Dorsal line with borders invaded by dorsal spots, dark pigmentation of gastrosteges often present.
g.—Preocular single, dorsal spots and dark pigmentation of gastrosteges usually very prominent.
T. o. vagrans ....p. 240
g².—Usually two preoculars, dorsal spots and pigmentation of gastrosteges usually less evident.
T. o. biscutatus ....p. 245
eee².—Dorsal line usually absent, or short, or indistinct.
fff.—Remnant of dorsal line usually present, preocular single, infralabials often more than ten.
T. o. couchii ....p. 251
fff².—No dorsal line, often more than one preocular, infralabials rarely more than ten.
gg.—Lateral lines usually present, dorsal spots fewer, or absent.
T. o. hammondii.............p. 256
gg².—Lateral lines usually absent, dorsal spots very numerous and prominent.
T. angustirostris.............p. 264
b².—Lateral stripe anteriorly upon scales of the third row only, light postoral crescents present.
T. marcianus..................p. 261
a².—Lateral light stripe anteriorly involving the scales of the fourth row.
T. megalops...................p. 263

The following facts also will be of aid in the determination of specimens:

1. Any red in the coloration indicates that the specimen belongs to one of the subspecies of *T. sirtalis* or to *T. o. ordinoides* or *T. o. atratus.*

2. Red on the upper surface of the head seems to be peculiar to the subspecies of *T. sirtalis.*

3. Red on the belly or in the dorsal line is distinctive of *T. o. ordinoides* and *T. o. atratus.*

4. The members of the *sirtalis* group have a much larger eye and longer posterior genials than are found in the subspecies of *T. ordinoides,* with the possible exception of *T. o. hammondii.*

5. The members of the *sirtalis* group practically always have 19—19—17 rows of scales and a single preocular.

6. In the subspecies of *T. ordinoides* 21 rows of scales are almost always present, except in *T. o. ordinoides* and *T. o. atratus.*

7. Two preoculars are most frequent in *T. angustirostris* and *T. o. biscutatus,* but are frequent in *T. o. hammondii* and *T. o. ordinoides.*

8. Absence of the dorsal stripe occurs only in four of the subspecies of *T. ordinoides*—viz., *hammondii, couchii, ordinoides,* and *atratus,*—and is usual in only *hammondii* and *couchii.*

THE SIRTALIS GROUP

Garter-snakes of the *sirtalis* type have been found in nearly every state of the Union. They have not definitely been shown to occur in Arizona and New Mexico. Since these snakes are distributed so widely, it is to be expected that racial differences may be found to distinguish the snakes of various portions of this territory. This has been found true, but the geographical races are surprisingly few. Of these, the best known are *sirtalis* and *parietalis,* which often have been regarded as distinct species. Those who, with the most adequate material, have studied the question, however, state emphatically that *sirtalis,*

of the eastern states, and *parietalis,* of the western, intergrade. It is upon their authority that trinomials are used here. Intergradation, it seems, occurs chiefly in the vicinity of the ninety-fifth (90° to 100°) Meridian. *Thamnophis sirtalis parietalis* ranges west from this area of intergradation. The snakes of the northwest coast of Oregon and Washington have been recognized by many authors as a distinct race, under the names *Thamnophis parietalis pickeringii* or, more properly, *Thamnophis sirtalis concinnus.*

Several names have been based upon individuals of these races. Thus, *parietalis* was originally described by Say in 1823 from material collected at Camp Missouri near Council Bluff. Blainville's *Coluber infernalis,* 1835, from California, is based upon a garter-snake belonging to this group, and Cope's *Eutænia sirtalis tetratænia,* from Pitt River, California, also is. Hallowell's type of *concinnus* (1852) was from Oregon Territory. It represented the dark northwest-coast form which Baird and Girard soon afterwards (1853) named *Eutainia pickeringii* from material secured at Puget Sound. Cope, in 1892, proposed the name *E. sirtalis trilineata* for specimens from Port Townsend, Oregon, and Fort Benton, Montana.

General Discussion

While the northwestern coastal snakes thus were distinguished from *parietalis* at an early date, and have since been recorded by most authors under a different name, no one has claimed that these two races showed any distinctive characters other than those of coloration. Ruthven states that "there is no character which will constantly distinguish specimens of *concinnus* from *parietalis.* The narrow dorsal stripe and lateral interspaces of the former will usually do so, but these may be exactly as in *parietalis.* Still, the fact that nearly all specimens from Washington and northern Oregon, west of the Cascade Range, are characterized by a marked predominance of black pigment and a narrow dorsal stripe justifies their recognition as a separate form." This was the opinion reached as the result of earlier studies set forth in "The Reptiles of the Pacific Coast and Great Basin," and now, with nearly 400 of these snakes before us, this opinion is unchanged. Although there is much variation in the amount of dark pigment and in the width of

the dorsal line these characters are sufficiently constant to serve for the recognition of *concinnus* as a subspecies distinct from *parietalis.*

As we pass south and east from the range of *concinnus* in California and southern Oregon we find a definite increase in the number of ventral plates. The snakes from the northwest coast have fewer gastrosteges and urosteges than the snakes from farther south and east in California. The greater difference is in the gastrostege counts, and these might perhaps be used alone, but the combination of gastrostege and urostege counts helps to bury individual variation. In a comparison of this kind it is, of course, necessary to separate the sexes, for the females have much lower counts than the males.

The following table shows these counts in specimens from many localities:

Table of combined gastrostege and urostege counts

Locality	Males			Females		
	No. of Specimens	Average	Extremes	No. of Specimens	Average	Extremes
British Columbia	2	249.5	248–251	7	229.9	226–234
Idaho.						
Twin Falls and Washington Cos.	3	245.3	241–248	8	235.9	229–247
Washington	11	242.5	239–250	10	230.1	227–238
Oregon.						
Clatsop Co	2	248	243–253	1	226	226
Tillamook Co	5	250.8	246–254	9	233.2	228–237
Yamhill Co	..	.....	....	1	240	240
Lincoln Co	..	.....	....	1	236	236
Benton Co	1	255	255	1	250	250
Lane Co	3	246.3	243–248	1	239	239
Coos Co	11	247.4	240–253	8	237.6	231–243
Douglas Co	9	248.3	242–255	5	231.2	224–237
Curry Co	7	246.4	241–251	15	236.5	221–246
Jackson Co	..	.....	....	1	253	253
Harney Co	1	248	248	..	.....	....
Klamath Co	1	254	254	..	.....	....
Utah	4	251	249–253	4	237.5	231–241
California.						
Del Norte Co	5	246.4	237–256	8	233	230–238
Shasta Co	1	243	243	2	241.5	239–244
Humboldt Co	6	251.2	245–254	3	234.3	231–240
Mendocino Co	6	249.7	231–258	5	241.2	231–251
Sonoma Co	1	251	251	3	229	215–233
Marin Co	2	254	253–255	1	230	230
Lassen Co	..	.....	....	1	237	237
Santa Clara Co	10	258.6	251–267	9	243.7	236–248
Monterey Co	5	260.4	253–267	3	244.6	236–252
Lake Co	..	.....	....	1	258	258
Alameda Co	1	265	265	2	.....	....
San Joaquin Co	..	.....	....	1	248	248
Merced Co	..	.....	....	1	240	240
Butte Co	4	260.5	258–266	8	244.3	237–253
Sutter Co	1	255	255	1	254	254
Mariposa Co	1	265	265	1	252	252
El Dorado Co	..	.....	....	2	249	245–253
Modoc Co	5	259.2	251–269	8	246.5	240–258
Los Angeles Co	2	263.3	254–270	1	245	245
San Bernardino Co	..	.....	....	1	248	248

It will be seen that while the average count in males from Washington is 245.5, the average in males from central and southern California ranges from 255 to 265; the extremes of variation in the latter area being 251 and 270, while in Washington specimens they are only 239 and 250. Similar differences are found in the counts of female specimens, the Washington average being 230.1, as against central and southern California averages of from 243.7 to 248. Intermediate localities show some intermediate counts, but in general it may be seen that the difference is quite great and constant enough to serve well for the separation of a southwestern race, *T. sirtalis infernalis,* from the northern subspecies, *T. sirtalis concinnus.* This difference in gastrosteges is clearly shown in Figure 1. It also is evident that *T. sirtalis concinnus* is not confined to the extreme northwest, but, on the contrary, occupies a strip close to the coast south nearly or quite to San Francisco Bay. In the extreme north *T. sirtalis concinnus* ranges east far from the coast, for the specimens from northern Idaho are of this dark race and it very possibly may be that Cope's type of *trilineata* from Fort Benton, Montana, also belongs here. A little farther south, however, *concinnus* does not range far from the ocean, as is shown by the specimens from Klamath County, Oregon, and Modoc County, California, which represent the race *T. sirtalis infernalis.*

Thamnophis sirtalis parietalis agrees with *T. sirtalis concinnus* in having a smaller number of ventral plates than is to be found in *T. sirtalis infernalis.* It differs from *T. s. concinnus* and resembles *T. s. infernalis* in its lighter style of coloration. Specimens at hand do not show where *Thamnophis sirtalis parietalis* meets the other two subspecies, or whether there are definite areas of intergradation between these forms. One would expect to find such a state of affairs in Nevada, southern Idaho, and perhaps in southeastern Oregon, but, unfortunately, our specimens from these areas are very few. The Idaho snakes are of the dark *T. s. concinnus* type, while those from Utah are definitely *T. s. parietalis.*

We thus recognize from the territory west of the Rocky Mountains three subspecies of *Thamnophis sirtalis,* as follows:—

1. Thamnophis sirtalis parietalis (Say)
2. Thamnophis sirtalis concinnus (Hallowell)
3. Thamnophis sirtalis infernalis (Blainville)

While these three are the only western races of *T. sirtalis* recognized in this review, it is far from certain that this num-

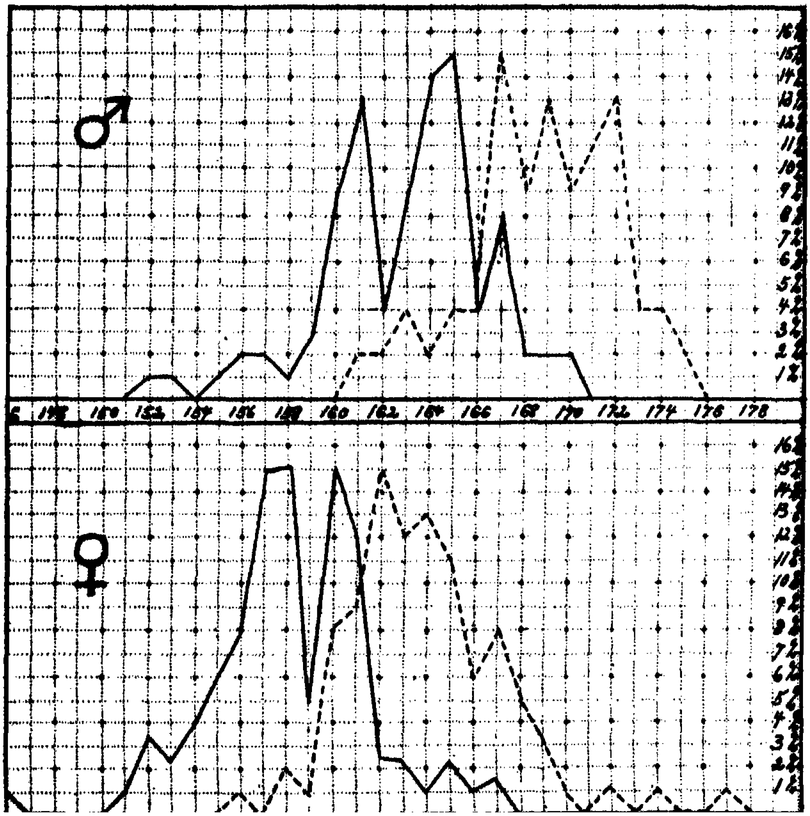


Figure 1

Fig. 1. This chart shows the number of gastrosteges in specimens of *Thamnophis sirtalis concinnus*, represented by a continuous line, and *Thamnophis sirtalis infernalis*, represented by a broken line. The upper half of the chart shows the counts in males, the lower half the counts in females. The chart shows the percentage of the total number of specimens of each sex having each number of gastrosteges, and brings out clearly the fact that in *T. s. infernalis* these scutes are more numerous than in *T. s. concinnus*.

ber might not be largely increased if very much larger series were at hand. We were able to distinguish easily, and with but few errors, the snakes of Idaho from those of the Puget region, and those of Palo Alto from those collected in the San Joaquin Valley, as we picked them from a large pile of specimens bearing numbers but no locality labels. The differences are too intangible to describe, but they must exist, and may become more evident when larger series can be studied. Some of the color differences which we now regard as individual may prove to be geographical, and the day may come when the herpetologist, with enormous series, will emulate the ornithologist and mammalogist in the multiplication of subspecies.

Thamnophis sirtalis parietalis (Say)

Prairie Garter-Snake.

Diagnosis.—Squamation similar to that of *T. s. concinnus* but coloration usually lighter and with more red, thus resembling *T. s. infernalis.*

Type Locality.—West side of the Missouri River, three miles above the mouth of Boyer's River.

Synonyms.—It seems that no other names have been based upon individuals of this subspecies as here restricted.

Range.—The great plains, west to Utah and perhaps eastern Nevada and southern Idaho.

We have examined specimens of *Thamnophis sirtalis parietalis* from the following localities:—

1. Bear River, Logan, Cache Co., Utah.
2. Fort Douglas, Salt Lake Co., Utah.
3. Woods Cross, Morgan Co., Utah.

Material.—Only 12 specimens have been studied by us.

Variation.—The loreal is 1—1 in all. The preoculars are 1—1 in all. The postoculars are 3—3 in all. The temporals

are 1+2—1+2 in eight, or 66%; 1+2—1+3 in three, or 25%; and 1+1—1+2 in one, or 8%. The supralabials are 7—7 in nine, or 75%; 7—8 in two, or 17%; and 8—8 in one, or 8%. The infralabials are 10—10 in seven, or 58%; 9—9 in four, or 33%; and 9—10 in one, or 8%. The scale-rows are 19—19—17 in all. The gastrosteges vary in number from 157 to 168, males having from 164 to 168, females from 157 to 166; the average in five males is 165.4, in seven females, 161.1. The urosteges vary from 74 to 87, males having from 84 to 87, females from 74 to 79; the average in four males is 85.2, in four females, 76.

These variations are shown in full in the following table of scale-counts. The series, of course, is too small to show the real limits of variation.

Scale counts in *Thamnophis sirtalis parietalis*

Number	Sex	Scale rows	Gastrosteges	Urosteges	Supralabials	Infralabials	Preoculars	Postoculars	Loreals	Temporals	Locality
S1778	♂	19—19—17—17	164	86+	7—7	10—9	1—1	3—3	1—1	1+2—1+2	1
14169	♀	19—19—17—17	166	75c	7—7	10—10	1—1	3—3	1—1	1+3—1+2	2
40403	♀	19—19—17—17	162	73+	7—7	10—10	1—1	3—3	1—1	1+2—1+2	3
40404	♀	19—19—17—17	158	68+	7—7	9—9	1—1	3—3	1—1	1+2—1+2	3
40405	♀	19—19—17—17	162	24+	7—7	10—10	1—1	3—3	1—1	1+2—1+2	3
40406	♀	19—19—17—17	157	74c	8—8	10—10	1—1	3—3	1—1	1+3—1+2	3
40407	♀	19—19—17—17	161	79c	7—7	9—9	1—1	3—3	1—1	1+2—1+3	3
40408	♀	19—19—17—17	162	76c	7—7	9—9	1—1	3—3	1—1	1+2—1+2	3
40409	♂	19—19—17—17	165	84c	8—7	10—10	1—1	3—3	1—1	1+2—1+2	3
40410	♂	19—19—17—17	168	85c	8—7	10—10	1—1	3—3	1—1	1+1—1+2	3
40411	♂	19—19—17—17	164	87c	7—7	9—9	1—1	3—3	1—1	1+2—1+2	3
40412	♂	19—19—17—17	166	85c	7—7	10—10	1—1	3—3	1—1	1+2—1+2	3

Remarks.—The specimens at hand are insufficient to show the western limits of the range of this subspecies and where and how it meets, or merges with, or is replaced by, *T. s. concinnus* and *T. s. infernalis*. The last named form ranges east at least to the western edge of Nevada, while *T. s. concinnus* seems to occur as far east as northern Idaho or, possibly, Montana. Many more specimens are needed from southern Idaho, eastern Oregon and all parts of Nevada, to throw light on these questions.

Thamnophis sirtalis concinnus (Hallowell)

Northwestern Garter-Snake.

Diagnosis.—Squamation similar to that of *T. s. parietalis.* Gastrosteges and urosteges average fewer than *T. s. infernalis.* Coloration usually darker than in either *T. s. parietalis* or *T. s. infernalis.*

Type Locality.—Oregon Territory.

Synonyms.—*Eutænia pickeringii* Baird & Girard, 1853; type locality Puget Sound. *Eutænia sirtalis trilineata* Cope, 1892; type localities "Port Townsend, Oregon", and Fort Benton, Montana. *Eutænia sirtalis tetratænia* (part?), Cope, 1875, no locality, and 1892, Puget Sound, Washington.

Range.—The coast region of British Columbia, Washington, Oregon, and California south to San Francisco Bay, intergrading toward the south and east in California with *T. s. infernalis.* In the far north, probably ranging east to Idaho, or possibly Montana.

We have examined specimens of *Thamnophis sirtalis concinnus* from the following localities:—

1. Lillooet River Valley, British Columbia.
2. Union Bay, Bayne Island, B. C.
3. Vancouver Island, B. C.
4. Alberni Valley, Vancouver Island, B. C.
5. Blue Lakes, Twin Falls Co., Idaho.
6. Weiser, Washington Co., Idaho.
7. San Juan Islands, Washington.
8. Lake Crescent, Clallam Co., Wash.
9. Darrington, Snohomish Co., Wash.
10. Seattle, King Co., Wash.
11. Quiniault, Chehalis Co., Wash.
12. Melbourne, Chehalis Co., Wash.
13. Longmire, Pierce Co., Wash.
14. Pierce Co., Wash.
15. Pullman, Whitman Co., Wash.
16. South Bend, Pacific Co., Wash.
17. Holcomb, Pacific Co., Wash.
18. Olney, Clatsop Co., Oregon.

19. Gearheart, Clatsop Co., Ore.
20. Garibaldi, Tillamook Co., Ore.
21. Tillamook, Tillamook Co., Ore.
22. Trask River, Tillamook Co., Ore.
23. Road to Nestucea between Grand Ronde and Dolph, Yamhill Co., Ore.
24. Road between Chitwood and Siletz River, Lincoln Co., Ore.
25. Road between Pioneer and Siletz River, Benton Co., Ore.
26. Alsea River, near Alsea, Benton Co., Ore.
27. Elmira, Lane Co., Ore.
28. June Lake and Siuslaw River, Lane Co., Ore.
29. Junction Lake and Deadwood Creek, Lane Co., Ore.
30. South Fork Coos River, Coos Co., Ore.
31. Sumner, Coos Co., Ore.
32. Coquille, Coos Co., Ore.
33. Myrtle Point, Coos Co., Ore.
34. Takeneitch Creek, Douglas Co., Ore.
35. Camas Mountains, Douglas Co., Ore.
36. Langlois, Curry Co., Ore.
37. Sixes River, Curry Co., Ore.
38. Port Orford, Curry Co., Ore.
39. Elk Creek, Curry Co., Ore.
40. Between Flores Creek and Rogue River, Curry Co., Ore.
41. Flores Creek, Curry Co., Ore.
42. Vicinity mouth of Rogue River, Curry Co., Ore.
43. Harbor, Curry Co., Ore.
44. Battle Creek, near Eagle Point, Jackson Co., Ore.
45. Smith River, Del Norte Co., California.
46. Crescent City, Del Norte Co., Cal.
47. Requa, Del Norte Co., Cal.
48. Sisson, Siskiyou Co., Cal.
49. Burney Creek, Shasta Co., Cal.
50. Redwood Creek, Orick, Humboldt Co., Cal.
51. Carlotta, Humboldt Co., Cal.
52. Maple Creek, Humboldt Co., Cal.
53. Samoa, Humboldt Bay, Humboldt Co., Cal.
54. Eureka, Humboldt Co., Cal.
55. Covelo, Mendocino Co., Cal.

56. Garcia River, half mile above mouth, Mendocino Co., Cal.
57. Sherwood, Mendocino Co., Cal.
58. Willits, Mendocino Co., Cal.
59. Mendocino, Mendocino Co., Cal.
60. Albion River, 2 miles below Comptche, Mendocino Co., Cal.
61. Kidd Creek, Sonoma Co., Cal.
62. Skaggs Springs, Sonoma Co., Cal.
63. Napa, Napa Co., Cal.
64. Inverness, Marin Co., Cal.
65. Point Reyes Station, Marin Co., Cal.
66. Tocaloma, Marin Co., Cal.
67. Willow Camp, Marin Co., Cal.

Material.—Two hundred and forty-six specimens have been studied by us.

Variation.—The loreal is 1—1 in two hundred and thirty-seven specimens (all counted). The preoculars are 1—1 in two hundred and thirty-six and 2—2 in one. The postoculars are 3—3 in two hundred and fifteen or 92%; 3—4 in thirteen or 5%; 2—3 in four, or 2%; 4—4 in one, and 2—2 in one. The temporals are 1+2—1+2 in two hundred and twenty-one, or 94%; 1+1—1+2 in five, or 2%; 1+2—1+3 in four, or 2%; 1+1—1+1 in four, or 2%; and 1+3—1+3 in one. The supralabials are 7—7 in one hundred and eighty-three, or 77%; 7—8 in forty-one, or 17%; and 8—8 in fourteen, or 6%. The infralabials are 10—10 in one hundred and sixty-nine, or 71%; 9—10 in forty-one, or 17%; 9—9 in fifteen, or 6%; 8—9 in eight, or 3%; 8—10 in two, or 1%; and 10—11 in two, or 1%. The scale-rows are 19—19—17 in all specimens. The gastrosteges vary in number from 146 to 170, males having from 150 to 170, females from 146 to 167; the average in ninety-nine males is 164.3, in one hundred and eighteen females, 156.4. The urosteges vary from 66 to 95, males having from 70 to 95, females from 66 to 91; the average in eighty males is 84.2, in eighty-eight females, 76.8.

These variations are shown in full in the following table of scale-counts.

Scale counts in *Thamnophis sirtalis concinnus*

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Local-ity
S5171	♀	19—19—17—17	159	67c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	1
S5174	♀	19—19—17—17	157	75c	7—7	10—9	1—1	3—3	1—1	1+2——1+2	1
S7212	♂	19—19—17	170	78c	7—7	10—10	1—1	3—3	1—1	1+2	2
C2297	♀	19—19—17—17	160	78c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	3
C2298	♂	19—19—17	...	84c	....	....	1—1	3—3	1—1	1+2+2—1+2+2	4
C2300	♂	19—19—17	170	81c	7—7	8—9	1—1	3—3	1—1	1+2+2—1+2+2	4
C2301	♂	19—19—17	154	73c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	4
C2302	♂	19—19—17	164	62+	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	4
C2303	♀	19—19—17	159	69c	7—7	10—10	1—1	3—4	1—1	1+2+2—1+3+2	4
C2304	♀	19—19—17	158	76c	7—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2	4
C2305	♀	19—19—17	160	69+	7—7	10—9	1—1	3—3	1—1	1+2+2—1+2+2	4
C2306	♀	19—19—17	161	72c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	4
C2307	♀	19—19—17	161	68+	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	4
S2649	♀	19—19—17—17	165	44+	7—8	9—10	1—1	3—4	1—1	1+2——1+2	5
S2650	♀	19—19—17—17	167	78c	7—7	10—9	1—1	3—3	1—1	1+2——1+2	5
S2651	♂	19—19—17—17	163	85c	7—7	9—9	1—1	3—3	1—1	1+2——1+2	5
S2652	♀	19—19—17—17	158	74c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	5
S2653	♂	19—19—17—17	160	81c	7—7	9—10	1—1	3—3	1—1	1+2——1+2	5
S2654	♂	19—19—17—17	164	85c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	5
S2655	♀	19—19—17—17	156	78c	7—8	10—10	1—1	3—3	1—1	1+2——1+2	5
S2656	♂	19—19—17—17	163	84c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	5
S2657	♀	19—19—17—17	154	37+	7—7	10—10	1—1	3—3	1—1	1+2——1+2	5
S2658	♂	19—19—17—17	165	82c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	5
S2659	♀	19—19—17—17	158	72c	7—7	10—10	1—1	3—4	1—1	1+2——1+2	5
S2663	♀	19—19—17—17	155	73c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	5
S1686	♀	19—19—17—17	162	80c	7—8	10—10	1—1	3—3	1—1	1+2——1+2	6
S6306	♀	19—19—17—17	166	79+	7—7	10—9	1—1	3—3	1—1	1+2——1+2	7
S6314	♀	19—19—17—17	161	77	7—7	10—10	1—1	3—3	1—1	1+2——1+2	7
30418	♂	19—19—17	163	62+	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	8
30419	♀	19—19—17	158	73c	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	8
30420	♀	19—19—17	157	71c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+1+2	8
30421	♀	19—19—17	157	68c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	8
30509	♂	19—19—17	164	81c	7—7	10—9	1—1	3—3	1—1	1+1——1+1	9
30510	♀	19—19—17	156	73c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	9
S4181	♀	19—19—17—17	167	53+	7—7	10—10	1—1	3—3	1—1	1+2——1+2	10
29941	♀	19—19—17	158	63+	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	11
29942	♀	19—19—17	160	67c	7—7	9—8	1—1	3—3	1—1	1+2+2—1+2+2	11
29943	♂	19—19—17	156	70c	8—8	9—10	1—1	3—3	1—1	1+2+2—1+2+2	11
29944	♀	19—19—17	160	47+	8—8	10—9	1—1	3—3	1—1	1+2+2—1+2+2	11
29945	♂	19—19—17	161	82c	7—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2	11
29946	♂	19—19—17	159	80c	7—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	11
29947	♀	19—19—17	160	72c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	11
29948	♀	19—19—17	161	73c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+1	11
29949	♀	19—19—17	157	59+	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	11
29928	♀	19—19—17	160	68c	7—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	12
29929	♂	19—19—17	166	84c	7—7	9—10	1—1	3—3	1—1	1+2+2—1+2+2	12
30396	♂	19—19—17	161	83c	7—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	13
S5151	♂	19—19—17—17	167	82c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	14
S2660	♂	19—19—17—17	157	72+	7—7	10—9	1—1	3—3	1—1	1+2——1+2	15
S2661	♂	19—19—17—17	162	81c	7—7	9—9	1—1	3—3	1—1	1+2——1+2	15
S2662	♂	19—19—17—17	163	76c	7—7	9—9	1—1	3—3	1—1	1+2——1+2	15
29881	♂	19—19—17	167	79c	7—7	10—10	1—1	3—3	1—1	1+2——1+2+2	16
29882	♀	19—19—17	160	71+	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	16
29920	♀	19—19—17	161	68c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	17
29921	♂	19—19—17	165	79c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	17
29872	♂	19—19—17	164	79c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	18
29873	♂	19—19—17	166	61+	7—7	10—10	1—1	3—3	1—1	1+2+2—1+1+2	18
29812	♂	19—19—17	165	88c	7—7	9—10	1—1	3—3	1—1	1+1+2—1+2+2	19
29813	♂	19—19—17	164	64+	....	10—10	1—1	3—3	1—1	1+2+2—1+2+2	19
29814	♂	19—19—17	160	48+	7—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2	19
29815	♀	19—19—17	159	67c	8—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	19
29715	♂	19—19—17	168	75+	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	20
29716	♀	19—19—17	158	58+	7—7	10—10	1—1	3—3	1—1	1+2——1+2	20
29717	♂	19—19—17	166	83+	7—7	10—9	1—1	3—3	1—1	1+2——1+2	20
29718	♂	19—19—17	167	79c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	20
29719	♀	19—19—17	158	76c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	20
29696	♂	19—19—17	165	77+	7—7	10—10	1—1	3—3	1—1	1+2——1+2	21
29698	♀	19—19—17	158	71+	7—7	10—8	1—1	4—3	1—1	1+2+2—1+2+2	21
29699	♀	19—19—17	156	70c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	21
29700	♀	19—19—17	160	69c	7—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	21
29701	♀	19—19—17	161	45+	7—7	9—8	1—1	3—3	1—1	1+2+2—1+2+2	21
29702	♂	19—19—17	165	88c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	21
29703	♀	19—19—17	159	72c	7—7	9—10	1—1	3—3	1—1	1+2+2—1+2+2	21
29704	♀	19—19—17	158	78c	8—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2	21
29705	♂	19—19—17	165	77+	7—7	10—9	1—1	3—3	1—1	1+2+2—1+2+2	21

Scale counts in *Thamnophis sirtalis concinnus*—Continued

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Local-ity
29706	♀	19—19—17	163	74c	7—7	9—8	1—1	3—3	1—1	1+2+2—1+2+2	21
29734	♀	19—19—17	157	71+	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	22
29735	♀	19—19—17	157	20+	8—8	9—10	1—1	3—3	1—1	1+2+2—1+2+2	22
29736	♀	19—19—17	161	74c	7—7	10—10	1—1	4—3	1—1	1+2+2—1+2+2	22
29737	♀	19—19—17	161	72c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	22
29738	♂	19—19—17	165	87c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	22
29739	♀	19—19—17	161	75c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	22
29740	♂	19—19—17	169	85c	7—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2	22
29741	♂	19—19—17	163	54+	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	22
S5307	♀	19—19—17—17	160	80c	7—7	9—10	1—1	3—3	1—1	1+2——1+2	23
S4426	♀	19—19—17—17	161	75c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	24
S4512	♂	19—19—17—17	169	86c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	25
S4504	♀	19—19—17—17	165	85c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	26
29622	♀	19—19—17	157	23+	7—7	9—9	1—1	4—3	1—1	1+2+2—1+2+2	27
29623	♂	19—19—17	165	83c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	27
29624	♂	19—19—17	162	86c	7—7	9—10	1—1	3—3	1—1	1+2+2—1+1+2	27
29625	♂	19—19—17	164	79c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	27
S4501	♀	19—19—17—17	160	79c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	28
S4501 (*a*)	..	19—19—17	157	70c	7—7	9—9	....	....	....	....	29
S4501 (*b*)	..	19—19—17	160	77+	....	....	....	....	....	....	29
S4501 (*c*)	..	19—19—17	159	72c	7—7	....	....	....	....	....	29
S4501 (*d*)	..	19—19—17	165	86c	7—7	9—9	....	....	....	....	29
S4501 (*e*)	..	19—19—17	158	78c	7—7	....	....	....	....	....	29
S4501 (*f*)	..	19—19—17	162	89c	7—7	—9	1—1	3—3	....	1+2——1+2	29
S4501 (*g*)	..	19—19—17	161	78c	7—7	....	....	....	....	....	29
S4501 (*h*)	♂	19—19—17	158	77c	7—7	....	....	....	....	....	29
S4501 (*i*)	♂	19—19—17	161	80c	7—7	....	....	....	....	1+2	29
S4484 (*a*)	..	19—19—17	169	90c	8—7	10—10	1—1	3—3	1—1	1+2——1+2	30
S4484 (*b*)	..	19—19—17	158	57+	7—7	10—10	1—1	3—3	1—1	1+2——1+2	30
S4484 (*c*)	..	19—19—17	165	93c	7—7	10—10	2—2	3—3	1—1	1+2——1+2	30
S4484 (*d*)	..	19—19—17	167	87c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	30
S4484 (*e*)	..	19—19—17	157	90c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	30
S4484 (*f*)	..	19—19—17	168	92c	8—7	10—10	1—1	3—3	1—1	1+2——1+2	30
S4484 (*g*)	..	19—19—17	156	80c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	30
S4484 (*h*)	..	19—19—17	157	79c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	30
S4446	♀	19—19—17—17	156	79c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	31
S4480	♀	19—19—17—17	157	51+	7—7	10—10	1—1	3—3	1—1	1+2——1+2	32
29441	♂	19—19—17	161	85c	7—7	9—10	1—1	3—3	1—1	1+2+2—1+2+2	33
29442	♂	19—19—17	160	85c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	33
29443	♀	19—19—17	160	76c	7—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	33
29444	♂	19—19—17	161	88c	7—8	9—9	1—1	3—3	1—1	1+2——1+2	33
29445	♂	19—19—17	166	81+	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	33
29446	♀	19—19—17	161	82c	7—7	10—10	1—1	3—2	1—1	1+2+2—1+2+2	33
29447	♂	19—19—17	161	67+	7—8	8—10	1—1	3—3	1—1	1+2——1+1	33
29448	♂	19—19—17	168	66+	7—7	10—10	1—1	4—3	1—1	1+1+2—1+1+2	33
29449	♂	19—19—17	164	42+	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	33
29450	♂	19—19—17	167	78c	8—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	33
29451	♀	19—19—17	158	81c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	33
29452	♀	19—19—17	157	81c	7—7	10—9	1—1	4—4	1—1	1+2——1+2	33
29453	♂	19—19—17	165	87c	7—7	10—10	1—1	3—3	1—1	1+1+2—1+1+2	33
29454	♀	19—19—17	161	77c	7—7	10—9	1—1	3—3	1—1	1+2+2—1+2+2	33
29455	♂	19—19—17	164	80c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	33
29456	♀	19—19—17	155	76c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	33
29457	♂	19—19—17	153	87c	7—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2	33
29458	♂	19—19—17	163	89c	7—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2	33
29459	♂	19—19—17	167	86c	7—7	8—9	1—1	3—3	1—1	1+2+2—1+2+2	33
29460	♂	19—19—17	167	82c	7—7	8—9	1—1	3—3	1—1	1+1+2—1+2+2	33
29461	♀	19—19—17	160	81c	7—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	33
S4218	♀	19—19—17—17	163	20+	7—7	10—10	1—1	3—3	1—1	1+2——1+2	33
S4415	♂	19—19—17—17	165	86c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	34
S4416	♀	19—19—17—17	154	72c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	34
S4417	♂	19—19—17—17	164	81c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	34
S4418	♂	19—19—17—17	161	88c	7—7	10—9	1—1	3—3	1—1	1+2——1+2	34
S4419	♀	19—19—17—17	157	72+	8—7	10—10	1—1	3—3	1—1	1+3——1+2	34
S4420	♂	19—19—17—17	165	89c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	34
S4421	♀	19—19—17—17	157	39+	8—7	10—10	1—1	3—3	1—1	1+2——1+2	34
S4422	♀	19—19—17—17	159	73c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	34
S4423	♀	19—19—17—17	158	66c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	34
S4424	♂	19—19—17—16	165	86c	7—7	10—10	1—1	4—3	1—1	1+2——1+2	34
S4425	♂	19—19—17—17	167	88c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	34
S4493	♀	19—19—17—17	160	77c	7—8	10—9	1—1	3—3	1—1	1+2——1+2	34
S4494	♂	19—19—17—17	160	87c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	34
S4495	♂	19—19—17—17	165	85c	7—7	9—10	1—1	3—3	1—1	1+2——1+2	34
S4496	♀	19—19—17—17	157	74c	7—7	9—10	1—1	3—3	1—1	1+2——1+2	34
S4497	♂	19—19—17—17	160	85c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	34

Scale counts in *Thamnophis sirtalis concinnus*—Continued

Number	Sex	Scale rows	Gastrosteges	Urosteges	Supralabials	Infralabials	Preoculars	Postoculars	Loreals	Temporals	Locality
84423	♀	19—19—17	158	66c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	34
84423 (*a*)	..	19—19—17	159	80c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	34
84423 (*b*)	..	19—19—17	155	72c	8—7	10—10	1—1	3—3	1—1	1+2——1+2	34
84423 (*c*)	♂	19—19—17	161	81c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	34
84423 (*d*)	..	19—19—17	154	71c	7—7	9—10	1—1	3—3	1—1	....	34
84423 (*e*)	..	19—19—17	154	75c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	34
84423 (*f*)	..	19—19—17	154	71c	7—8	10—10	1—1	3—3	1—1	1+2——1+2	34
84423 (*g*)	..	19—19—17	155	70c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	34
84423 (*h*)	♂	19—19—17	158	78c	7—7	10—9	1—1	3—3	1—1	1+2——1+2	34
84496	♀	19—19—17	157	74c	7—7	9—10	1—1	3—3	1—1	1+2——1+2	34
84496 (*a*)	♂	19—19—17	155	79c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	34
84496 (*b*)	..	19—19—17	150	75c	7—7	9—10	1—1	3—3	1—1	1+2——1+2	34
84496 (*c*)	..	19—19—17	156	78c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	34
84496 (*d*)	..	19—19—17	155	73c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	34
84496 (*e*)	..	19—19—17	153	74c	8—7	10—10	1—1	3—2	1—1	1+2——1+2	34
84496 (*f*)	♂	19—19—17	162	85c	7—8	10—10	1—1	3—3	1—1	1+2——1+2	34
84496 (*g*)	♂	19—19—17	159	84c	7—7	10—9	1—1	3—3	1—1	1+2——1+2	34
84496 (*h*)	..	19—19—17	158	72c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	34
84496 (*i*)	..	19—19—17	154	81c	7—7	9—8	1—1	3—2	1—1	1+2——1+2	34
29494	♀	19—19—17	160	77+	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	35
29418	♂	19—19—17	164	78+	7—7	10—9	1—1	3—3	1—1	1+1+2—1+1+2	36
84449	♂	19—19—17—17	167	82c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	37
84450	♀	19—19—17—15	159	81c	8—7	10—10	1—1	3—3	1—1	1+2——1+2	37
29390	♀	19—19—17	156	74c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	38
29391	♀	19—19—17	158	78c	8—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	38
29392	♂	19—19—17	162	87c	7—7	10—10	1—1	3—4	1—1	1+2+2—1+2+2	38
29393	♀	19—19—17	157	83c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	38
29394	♀	19—19—17	155	81c	7—7	10—10	1—1	3—4	1—1	1+2+2—1+2+2	38
29395	♀	19—19—17	157	77c	7—7	10—10	1—1	3—3	1—1	1+2+3—1+2+2	38
29396	♀	19—19—17	156	79c	8—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	38
84443	♂	19—19—17—17	160	86c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	39
84463	♀	19—19—17—17	161	79+	7—8	10—10	1—1	3—3	1—1	1+2——1+2	40
84451	♂	19—19—17—17	161	86c	8—7	10—10	1—1	3—3	1—1	1+2——1+2	41
84437	♀	19—19—17—17	158	77c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	42
84438	♀	19—19—17—17	157	78c	7—8	8—9	1—1	3—3	1—1	1+2——1+2	42
84439	♀	19—19—17—17	155	81c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	42
29262	♀	19—19—17	161	83c	8—8	11—10	1—1	3—3	1—1	1+2+2—1+2+2	43
29264	♀	19—19—17	156	46+	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	43
29265	♀	19—19—17	154	85c	8—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	43
29266	♂	19—19—17	165	86c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	43
29267	♀	19—19—17	160	84c	7—7	10—10	1—1	3—3	1—1	1+3+2—1+2+2	43
84441	♀	19—19—17—17	162	91c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	44
29212	♂	19—19—17	164	77c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	45
29222	♀	19—19—17	152	78c	8—8	10—10	1—1	2—2	1—1	1+2+2—1+2+2	46
29231	♂	19—19—17	163	89c	8—7	10—9	1—1	3—3	1—1	1+2+2—1+2+2	46
29232	♀	19—19—17	152	78c	7—7	9—10	1—1	3—3	1—1	1+2+2—1+2+2	46
29233	♂	19—19—17	156	81c	7—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	46
29234	♀	19—19—17	156	75c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	46
29235	♀	19—19—17	158	80c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	46
29083	♀	19—19—17	153	19+	7—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	47
29084	♂	19—19—17	161	86+	7—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	47
29086	♂	19—19—17	160	89c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	47
29087	♂	19—19—17	164	92c	8—8	9—10	1—1	3—3	1—1	1+2+2—1+2+2	47
29088	♀	19—19—17	158	77c	7—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	47
29089	♀	19—19—17	157	78c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	47
29092	♀	19—19—17	152	78c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	47
86609	♀	19—19—17—17	155	80c	7—8	10—10	1—1	3—3	1—1	1+2——1+2	47
86610	♀	19—19—17—17	152	35+	7—7	10—10	1—1	3—3	1—1	1+2——1+2	47
84314	♂	19—19—17—17	166	77+	7—7	10—10	1—1	3—3	1—1	1+3——1+2	48
86441	♂	19—19—17—17	167	76c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	49
86442	♀	19—19—17—17	164	80c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	49
86308	♀	19—19—17—17	160	79c	7—7	11—10	1—1	3—4	1—1	1+2——1+2	49
84261	♀	19—19—17—17	155	85c	7—8	10—10	1—1	3—3	1—1	1+2——1+2	50
28828	♂	19—19—17	157	95c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	51
28835	♀	19—19—17	156	75c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	51
28836	♂	19—19—17	163	91c	8—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	51
28838	♂	19—19—17	164	89c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	51
84262	♂	19—19—17—17	161	91c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	52
84263	♂	19—19—17—17	161	48+	7—7	10—10	1—1	3—3	1—1	1+2——1+2	52
C2321	♀	19—19—17	158	77c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2	53
C2318	♂	19—19—17	159	86c	7—7	10—9	1—1	3—3	1—1	1+2+2—1+2+1	54
C2319	♂	19—19—17	161	90c	7—7	9—9	1—1	3—3	1—1	1+2+1—1+2+2	54
C5318	♀	19—19—17	162	84c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	55
C5319	♀	19—19—17	165	86c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	55
C5320	♂	19—19—17	165	91c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	55

Scale counts in *Thamnophis sirtalis concinnus*—Continued

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Locality
S4246	♀	19—19—17—17	151	76+	7—7	10—10	1—1	3—3	1—1	1+2———1+2	56
S4235	♀	19—19—17—17	146	83c	7—7	10—10	1—1	3—3	1—1	1+2———1+2	56
C1162	♂	19—19—17	164	91c	7—7	10—9	1—1	3—3	1—1	1+2+2—1+2+2	57
C1164	♀	19—19—17	156	79c	7—7	10—9	1—1	3—4	1—1	1+2+1—1+2+1	57
28667	♂	19—19—17	160	83c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	58
28668	♀	19—19—17	158	57+	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	58
28669	♂	19—19—17	167	88c	7—7	10—9	1—1	3—3	1—1	1+2+2—1+2+2	58
C5325	♀	19—19—17	163	80c	7—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	58
C5316	♂	19—19—17	150	81c	8—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	59
S4239	♀	19—19—17—17	153	78c	7—7	10—10	1—1	3—3	1—1	1+2———1+2	60
27981	♀	19—19—17	158	27+	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	61
28022	♀	19—19—17	160	54+	7—7	10—10	1—1	3—3	1—1	1+2———1+2+2	62
28023	♀	19—19—17	154	79c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	62
28026	♂	19—19—17	160	91c	7—7	9—10	1—1	3—3	1—1	1+2+2—1+2+2	62
28027	♀	19—19—17	160	79c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	62
28028	♀	19—19—17	157	82c	7—7	10—9	1—1	3—3	1—1	1+2+2—1+2+2	62
C4315	♀	19—19—17	158	44+	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	63
C5294	♀	19—19—17	153	77c	7—8	10—9	1—1	4—3	1—1	1+2+3—1+2+3	64
C5289	♂	19—19—17	163	92c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	65
27815	♂	19—19—17	161	92c	7—7	10—10	1—1	3—3	1—1	1+3———1+3	66
39682	♂	19—19—17—17	167	68+	7—7	10—10	1—1	3—3	1—1	1+2———1+2	67

Remarks.—While a dark style of coloration with a tendency toward narrow lines is characteristic of this subspecies, this type of coloration is by no means constant. Specimens similar in color to the type of *pickeringii* seem to be very rare even in the far north. In general, the difference from *T. s. parietalis* and *T. s. infernalis* lies in an increase in the dark pigment, both dorsally and ventrally, rather than in a marked narrowing of the lines or a reduction in the amount of red in the coloration. Some specimens from Oregon are no darker than Californian *T. s. infernalis,* and show red heads and often much red on the body. Others are quite dark. Upon the whole, and notwithstanding wide individual variation everywhere, it may be said that the coloration becomes lighter toward the south and is gradually changed to that of *T. s. infernalis.* This color change seems to occur more rapidly (i. e., farther north) than the change in number of gastrosteges. The latter change has been discussed under the heading The Sirtalis Group.

Thamnophis sirtalis infernalis (Blainville)

Pacific Garter-Snake.

Diagnosis.—Gastrosteges and urosteges average more numerous than in *T. s. parietalis* and *T. s. concinnus.* Coloration usually lighter, with broader lines and more red than in *T. s. concinnus,* similar to that of *T. s. parietalis.*

Thamnophis sirtalis infernalis, Pacific Garter-Snake:—Photograph from living adult male (No. 39197) collected at Pacific Grove, Monterey County, California, May 11, 1914.

Type Locality.—California.

Synonyms.—*Eutænia sirtalis tetratænia* (part?), Cope, 1875, no locality, and 1891, Pitt River, Cal.

Range.—California east and south of the northwest coast region, south to San Bernardino County, east to Modoc County, and Lake Tahoe. In Oregon about the Klamath Lakes.

We have examined specimens of *Thamnophis sirtalis infernalis* from the following localities:—

1. Oroville, Butte Co., California.
2. West Butte, Sutter Co., Cal.
3. Kelseyville, Lake Co., Cal.
4. Fyffe, El Dorado Co., Cal.
5. Yosemite Valley, Mariposa Co., Cal.
6. Fresno, Fresno Co., Cal.
7. Isabella, Kern Co., Cal.
8. Weldon, Kern Co., Cal.
9. Buttonwillow, Kern Co., Cal.
10. Los Baños, Merced Co., Cal.
11. Banta, San Joaquin Co., Cal.
12. Walnut Creek, Contra Costa Co., Cal.
13. Berkeley, Alameda Co., Cal.
14. Palo Alto, Santa Clara Co., Cal.
15. Stanford University, Santa Clara Co., Cal.
16. Castro, Santa Clara Co., Cal.
17. Pacific Grove, Monterey Co., Cal.
18. Seaside, Monterey Co., Cal.
19. Carmel, Monterey Co., Cal.
20. Mount Mars, Monterey Co., Cal.
21. El Nogal, Los Angeles Co., Cal.
22. Colton, San Bernardino Co., Cal.
23. Bixby, Los Angeles Co., Cal.
24. Los Angeles, Los Angeles, Co., Cal.
25. Merrill, Klamath Co., Oregon.
26. Goose Lake, Modoc Co., Cal.
27. Davis Creek, Modoc Co., Cal.
28. Warner Mountains, Modoc Co., Cal.
29. Cedarville, Modoc Co., Cal.
30. Lake Tahoe, El Dorado Co., Cal.
31. Snelling, Merced Co., Cal.

32. Coulterville, Mariposa Co., Cal.
33. Pleasant Valley, Mariposa Co., Cal.
34. Marshy Meadow, Yosemite National Park, Cal.
35. Klamath Falls, Klamath Co., Oregon.

Material.—We have used one hundred and thirty-five specimens in this study.

Variation.—The loreal is 1—1 in all. The preoculars are 1—1 in all except one specimen with 1—2 and two with 2—2. The postoculars are 3—3 in ninety-five, or 73%; 3—4 in twenty-five, or 19%; 4—4 in seven, or 5%; 2—3 in three, or 2%; and 2—4 in one, or 1%. The temporals are 1+2—1+2 in one hundred and fourteen, or 88%; 1+2—1+3 in eight, or 6%; 1+1—1+2 in three, or 2%; 1+1—1+1 in one, or 1%; 2+2—2+2 in one, or 1%; 1+3—1+3 in one, or 1%; and 1+2—2+2 in one, or 1%. The supralabials are 7—7 in one hundred and four, or 80%; 7—8 in seventeen, or 13%; 8—8 in eight, or 6%; and 9—9 in one, or 1%. The infralabials are 10—10 in one hundred and ten, or 85%; 9—10 in thirteen, or 10%; 9—9 in three, or 2%; 10—11 in two, or 1%; and 9—8 in two, or 1%. The scale-rows are 19—19—17 in one hundred and thirty-four and 19—21—19—17 in one. The gastrosteges vary in number from 156 to 177, males having from 161 to 175, females from 156 to 174; the average in forty-seven males is 168.7, in eighty-one females, 163.7. The urosteges vary from 74 to 97, males having from 82 to 97, females from 74 to 93; the average in thirty-eight males is 89.8, in fifty females, 82.8.

These variations are shown in full in the following table of scale-counts.

Scale counts in *Thamnophis sirtalis infernalis*

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Local-ity
C4023	♀	19—19—17	164	83c	7—7	10—10	1—1	3—3	1—1	1+2———1+2	1
C4024	♀	19—19—17	161	79c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	1
C4025	♂	19—19—17	171	47+	7—7	10—10	1—1	4—3	1—1	1+2+2—1+2+2	1
C4026	♀	19—19—17	163	74c	7—7	—10	1—1	3—3	1—1	1+2+2—1+2+2	1
C4027	♂	19—19—17	169	90c	7—7	10—10	1—1	3—4	1—1	1+2+2—1+2+2	1
C4028	♂	19—19—17	172	36+	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	1
C4029	♂	19—19—17	167	91c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	1
C4030	♀	19—19—17	163	85c	7—7	10—10	1—1	3—3	1—1	1+2———1+2	1
C4031	♂	19—19—17	172	94c	7—7	10—9	1—1	3—3	1—1	1+2+2—1+2+2	1
C4032	♂	19—19—17	166	93c	7—7	10—10	1—1	4—4	1—1	1+2+2—1+2+3	1
C4033	♀	19—19—17	163	90c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	1
C4034	♀	19—19—17	160	85c	7—8	10—10	2—2	3—3	1—1	....	1
C4035	♀	19—19—17	162	82c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	1
C4036	♀	19—19—17	165	57+	7—7	10—10	1—1	3—4	1—1	1+2+2—1+2+2	1
C4037	♀	19—19—17	164	76+	7—8	10—10	1—1	3—3	1—1	1+2———1+2+2	1
C4038	♀	19—19—17	160	26+	7—7	9—10	1—1	3—3	1—1	1+2———1+2	1
C4020	♀	19—19—17	167	87c	....	....	....	....	....	....	2
C4021	♂	19—19—17	...	85c	....	....	....	....	....	....	2
C4022	♂	19—19—17	165	90c	7—7	10—10	1—1	3—4	1—1	1+2+2—1+2+2	2
S1742	♀	19—19—17—17	165	93c	7—7	10—10	1—1	3—3	1—1	1+1———1+2	3
S4367	♀	19—19—17—17	164	89c	8—7	10—10	1—1	4—3	1—1	1+3———1+2	4
C2488	♀	19—19—17	169	46+	7—7	9—10	1—1	3—3	1—1	1+2+2—1+2+2	5
C2489	♂	19—19—17	170	95c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	5
C2491	♀	19—19—17	162	30+	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	5
C2490	♀	19—19—17	166	86c	8—7	10—10	1—1	3—3	1—1	1+2———1+2	5
S1691	♀	19—19—17—17	158	48+	8—7	10—10	1—1	3—3	1—1	1+2———1+2	5
S4140	♀	19—19—17—17	168	81c	7—7	10—10	1—1	3—3	1—1	1+2———1+2	6
S4141	♀	19—19—17—17	168	44+	7—7	10—10	1—1	3—3	1—1	1+2———1+2	6
S4142	♀	19—19—17—17	162	82c	8—8	10—10	1—1	3—3	1—1	1+2———1+2	6
S4143	♀	19—19—17—17	164	81c	7—7	9—9	1—1	3—3	1—1	1+2———1+2	6
S4145	♀	19—19—17—17	163	60+	7—7	10—10	1—1	3—3	1—1	1+2———1+2	6
S4146	♂	19—19—17—17	173	77+	7—7	10—10	1—1	3—3	1—1	1+2———1+2	6
S4147	♀	19—19—17—17	169	83c	7—7	10—10	1—1	2—3	1—1	1+2———1+2	6
C2801	♀	19—19—17	163	80+	8—8	10—10	1—1	3—3	1—1	1+2———1+2	7
C2802	♀	19—19—17	164	85c	7—7	10—10	1—1	3—3	1—1	—1+2+2	7
C2803	♀	19—19—17	160	85c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+3+2	8
C2804	♀	19—19—17	165	51+	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	8
C2805	♀	19—19—17	162	85c	7—7	10—10	1—1	2—3	1—1	1+2———1+2	8
39554	♂	19—19—17—17	172	85c	7—7	10—10	1—1	3—4	1—1	1+2———1+2	9
13633	♀	19—19—17	164	37+	7—7	10—10	1—1	3—3	1—1	1+2+3—1+2+2	10
13634	♀	X—19—17	165	75c	7—7	X—X	X—X	X—X	X—X	1+2+2—1+2+2	10
.....	♀	19—19—17—17	164	76c	7—7	10—10	1—1	3—3	1—1	1+2———1+2	10
S1800	♀	19—19—17—17	167	81c	7—7	10—10	1—1	3—4	1—1	1+2———1+2	11
C4039	♀	19—19—17	163	64+	7—7	10—10	1—1	3—3	1—1	1+2+2—1+3+3	12
C6137	♀	19—19—17	162	37+	7—7	9—10	1—1	4—3	1—1	1+2+3—1+2+2	12
C2447	♂	19—19—17	172	93c	7—7	10—10	1—1	3—4	1—1	1+3+2—1+2+2	13
Field 4	♀	19—19—17—17	166	83+	7—7	10—10	1—1	3—3	1—1	1+2———1+2	14
S1148	♀	19—19—17—17	156	80c	7—7	9—9	1—1	3—3	1—1	1+2———1+2	14
S1210	♂	19—19—17—17	170	97c	8—7	10—10	1—1	3—3	1—1	1+2———1+2	14
S1791	♂	19—19—17—17	172	67+	7—7	10—10	1—1	3—3	1—1	1+2———1+2	14
S1792	♀	19—19—17—17	158	81c	7—7	10—10	1—1	4—3	1—1	1+2———1+2	14
S1807	♂	19—19—17—17	170	89c	7—7	10—10	1—1	3—3	1—1	1+2———1+2	14
S4021	♂	19—19—17—17	167	87c	7—7	10—10	1—1	4—4	1—1	1+2———1+2	14
S4136	♀	19—19—17—17	165	42+	8—8	10—10	1—1	3—3	1—1	1+2———1+3	14
S4137	♀	19—19—17—17	160	79c	7—7	10—10	1—1	3—3	1—1	1+2———1+2	14
S4224	♀	19—19—17—17	165	82c	7—8	10—10	1—1	3—4	1—1	1+2———1+2	14
S5262	♀	19—19—17—17	161	81c	7—7	10—10	1—1	3—3	1—1.	1+2———1+2	14
S5263	♂	19—19—17—17	169	93c	7—7	10—10	1—1	4—4	1—1	1+2———1+2	14
SR20	♀	19—19—17—17	161	86c	7—7	10—10	1—1	4—2	1—1	1+2———1+2	15
S1147	♂	19—19—17—17	169	89c	7—7	10—10	1—1	3—3	1—1	1+2———1+2	15
S1188	♀	19—19—17—17	163	85c	7—7	10—10	1—1	3—3	1—1	1+2———1+2	15
S1189	♀	19—19—17—17	159	76+	7—7	10—10	1—1	3—3	1—1	1+2———1+2	15
S1190	♀	19—19—17—17	167	47+	7—7	10—10	1—1	3—3	1—1	1+3———1+3	15
S1192	♀	19—21—19—17	161	87c	8—7	10—10	1—1	3—3	1—1	1+2———1+2	15
S1193	♂	19—19—17—17	168	89c	7—7	9—9	1—1	3—3	1—1	1+2———1+2	15
S1194	♂	19—19—17—17	167	78+	7—7	8—9	1—1	3—3	1—1	1+2———1+2	15
S1195	♂	19—19—17—17	166	94c	7—7	10—10	1—1	3—3	1—1	1+3———1+2	15
S5310	♂	19—19—17—17	170	94c	7—7	10—10	1—1	4—4	1—1	1+2———1+2	15
S6379	♂	19—19—17—15	163	88c	8—8	10—10	1—1	3—3	1—1	1+1———1+2	15
S6381	♂	19—19—17—15	167	87c	7—7	10—10	1—1	3—3	1—1	1+2———1+2	15
S6382	♀	19—19—17—17	162	68+	7—7	10—10	1—1	3—3	1—1	1+2———1+2	15
S1653	♀	19—19—17—17	165	82c	7—7	10—10	1—1	3—3	1—1	1+2———1+2	15
38944	♂	19—19—17	168	88c	8—7	9—10	1—1	3—4	1—1	1+2+2—1+2+2	16
39196	♂	19—19—17	169	90c	7—7	9—10	1—1	4—3	1—1	1+2+2—1+2+2	17
39197	♂	19—19—17	169	93c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	17

Scale counts in *Thamnophis sirtalis infernalis*—Continued

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Local-ity
13755	♀	19—19—17	166	39+	7—7	10—10	1—1	3—3	1—1	1+2———1+2	17
SR63	♂	19—19—17—17	169	92c	8—7	10—10	1—1	4—4	1—1	1+2———1+2	17
S5162	♀	19—19—17—17	160	76c	7—7	10—9	1—1	3—3	1—1	1+2———1+2	17
S5162 (*a*)	..	19—19—17	160	80c	7—7	9—10	1—1	3—3	1—1	1+2———1+2	17
S5162 (*b*)	..	19—19—17	157	77c	8—7	10—10	1—1	3—3	1—1	1+2———1+2	17
S5162 (*c*)	..	19—19—17	160	76c	7—8	10—10	1—1	3—3	1—1	1+2———1+2	17
S5162 (*d*)	..	19—19—17	159	80c	7—7	9—10	1—1	3—3	1—1	1+2———1+2	17
S5162 (*e*)	..	19—19—17	161	80c	7—7	10—10	1—1	3—3	1—1	1+2———1+2	17
S5162 (*f*)	..	19—19—17	151	79c	7—7	10—10	1—1	3—3	1—1	1+2———1+2	17
S5162 (*g*)	♂	19—19—17	164	88c	7—7	10—10	1—1	3—3	1—1	1+2———1+2	17
S5162 (*h*)	♂	19—19—17	167	91c	7—7	10—10	1—1	3—3	1—1	1+2———1+2	17
S5162 (*i*)	♂	19—19—17	161	85c	7—7	10—9	1—2	3—3	1—1	1+2———1+2	17
S5162 (*j*)	♂	19—19—17	163	86c	7—7	10—10	1—1	3—3	1—1	1+3———1+2	17
S5162 (*k*)	..	19—19—17	160	77c	7—7	10—10	1—1	3—3	1—1	1+2———1+2	17
S5162 (*l*)	..	19—19—17	161	79c	7—7	10—10	1—1	3—3	1—1	1+2———1+2	17
S5162 (*m*)	♂	19—19—17	165	90c	9—9	10—10	1—1	3—3	1—1	1+2———1+2	17
13762	♀	19—19—17	164	88c	7—7	10—10	1—1	3—3	1—1	1+1———1+1	18
13763	♀	19—19—17	162	84c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	18
13754	♂	19—19—17	173	94c	7—7	10—10	1—1	4—3	1—1	1+2+2—1+2+2	19
20963	♀	19—19—17	162	68+	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	19
27308	♂	19—19—17	171	82c	7—7	10—10	1—1	3—4	1—1	1+2+2—1+2+2	19
S5192	..	19—19—17—17	165	4+	7—7	10—10	1—1	4—4	1—1	1+3———1+2	20
27474	♂	19—19—17	174	75+	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2	21
27475	♀	19—19—17	167	81c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	21
C27	♂	19—19—17	172	82c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	22
C57	♀	19—19—17	163	....	8—8	10—10	1—1	3—3	1—1	1+2———1+2	22
C58	♂	19—19—17	171	85c	7—7	10—10	1—1	3—3	1—1	1+2———1+2	22
C763	♀	19—19—17	167	78c	8—8	10—10	1—1	3—3	1—1	1+2———1+2	23
C764	♂	19—19—17	174	96c	7—7	10—10	1—1	3—4	1—1	2+2———2+2	23
40033	♀	19—19—17—17	174	85c	8—8	10—10	1—1	3—3	1—1	1+2———1+2	24
C5429	♀	19—19—17	168	33+	7—8	10—10	1—1	4—4	1—1	1+2+2—1+2+2	25
C5430	♂	19—19—17	167	87c	7—7	10—11	1—1	4—3	1—1	1+2+1—1+2+1	25
C2148	♂	19—19—17	171	91c	8—7	10—10	1—1	3—2	1—1	1+2+2—1+2+2	26
C2150	♀	19—19—17	163	78c	8—7	10—10	1—1	4—3	1—1	1+2+2—1+2+2	26
C2151	♂	19—19—17	175	94c	7—7	10—10	2—2	3—3	1—1	1+2+2—1+2+2	26
C2154	♀	19—19—17	167	39+	7—7	9—10	1—1	4—3	1—1	———1+2+2	26
C2155	♀	19—19—17	161	41+	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	26
C2156	♂	19—19—17	167	89c	7—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	26
C2157	♂	19—19—17	171	87c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	26
C2159	♂	19—19—17	168	48+	7—7	10—10	1—1	3—3	1—1	1+2+3—1+2+2	26
C2160	♀	19—19—17	161	83c	8—7	9—10	1—1	4—3	1—1	1+2———1+2	26
C2161	♀	19—19—17	162	62+	7—7	10—10	1—1	3—3	1—1	1+2———1+2	26
C2162	♂	19—19—17	168	16+	7—7	8—9	1—1	3—3	1—1	1+1+2—1+2+2	27
C2174	♀	19—19—17	162	82+	8—7	10—10	1—1	4—3	1—1	1+2+2—1+2+2	28
C2175	♀	19—19—17	160	81c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	28
C2176	♂	19—19—17	162	89c	7—7	10—10	1—1	4—3	1—1	1+2+2—1+2+2	28
C2177	♀	19—19—17	169	84c	....	11—10	....	3—3	....	1+2———1+2	28
C2178	♀	19—19—17	168	90c	7—7	10—10	1—1	3—4	1—1	1+2+2—1+2+2	28
C2182	♀	19—19—17	170	81c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	28
C2180	♀	19—19—17	163	77c	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	29
C2181	♀	19—19—17	165	....	7—7	10—10	1—1	3—4	1—1	1+2+2—1+2+2	29
39646	♀	19—19—17—17	162	83c	7—7	10—10	1—1	3—3	1—1	1+2———1+2	30
C5894	♀	19—19—17—17	164	71+	7—7	10—10	1—1	3—3	1—1	1+2———1+2	31
C5896	♀	19—19—17—17	161	88c	7—7	10—10	1—1	4—3	1—1	1+2———1+2	32
C5895	♀ ?	19—19—17—17	177	92c	7—7	10—10	1—1	3—3	1—1	1+2———1+2	33
C5905	♀	19—19—17—17	164	86c	8—8	10—10	1—1	3—3	1—1	1+2———1+2	33
C5900	♀	19—19—17	157	81c	7—7	10—10	1—1	3—3	1—1	2+2———1+2	34
C5901	♀	19—19—17—17	172	75c	X—7	X—X	1—1	X—3	1—1	———1+2	34
C5903	♀	19—19—17—17	162	81c	7—7	10—10	1—1	3—3	1—1	1+2———1+2	34
C5959	♀	19—19—17—17	164	89c	7—7	10—9	1—1	3—3	1—1	1+2———1+2	5
20388	♀	19—19—17	167	79	7—7	10—10	....	....	....	1+1+2—1+2+2	35
20389	♀	19—19—17	166	79+	8—7	10—9	....	....	....	1+2+2—1+2+2	35

The following localities are represented each by one specimen. The material being so limited we are unable to state definitely to which subspecies of *sirtalis* these specimens should be referred.

1. Willow Lake, Tehama Co., California.
2. Susanville, Lassen Co., Cal.
3. Fallen Leaf Lake, El Dorado Co., Cal.
4. Silver River, Harney Co., Oregon.
5. Vicinity Nixon, Washoe Co., Nevada.

Scale counts of *Thamnophis sirtalis*, subspecies?

Number	Sex	Scale rows	Gastrosteges	Urosteges	Supralabials	Infralabials	Preoculars	Postoculars	Loreals	Temporals	Locality
39643	♀	19—19—17	161	34+	8—8	10—10	1—1	3—3	1—1	1+2——1+2	1
86543	♀	19—19—17	160	77c	7—7	10—10	1—1	4—3	1—1	1+2——1+2	2
36323	♀	19—19—17	162	72c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	3
86507	♂	19—19—17	169	79c	7—7	9—9	1—1	2—3	1—1	1+2——1+2	4
8	♀	19—19—17	...	50+	8—8	10—10	1—1	3—3	1—1	1+2——1+2	5

Remarks.—This subspecies differs from both *T. s. parietalis* and *T. s. concinnus* in having a greater number of gastrosteges and urosteges. This is clearly shown in the following table of average counts:

	♂	♀
Gastrosteges		
parietalis	165.4	161.1
concinnus	164.3	156.4
infernalis	168.7	163.7
Urosteges		
parietalis	85.2	76.
concinnus	84.2	76.8
infernalis	89.8	82.8

It probably will prove to be impossible to draw any very definite limits to the areas occupied by this form and by *T. s. concinnus*. This must be so, for one gradually changes into the other. The area of intergradation is a broad one, individual variation is great, and opinions may easily differ as to geographical limits. Our own views are expressed in the lists of localities given under each subspecies. These indicate that to

T. s. concinnus are referred snakes from Del Norte, Siskiyou, Shasta, Humboldt, Mendocino, Sonoma, Napa, and Marin counties, while those from elsewhere in California are regarded as *T. s. infernalis.*

There is much variation in color. Certain types of coloration seem to be more frequent in certain localities than elsewhere. Thus, the majority of the snakes from the San Joaquin and Sacramento valleys and the Klamath region differ in appearance from those from Santa Clara County and the southern coast. Much larger series might perhaps throw light upon these conditions, which now are obscure.

Some specimens have bright red heads. Others, perhaps of the same lot, have no red, or heads that are partially red. The red-headed snakes are of both sexes, various ages, and all sorts of localities.

One specimen had eaten a full-grown toad.

Thamnophis eques (Reuss)

Diagnosis.—Squamation similar to that of the other members of the *sirtalis* group but supralabials usually eight; prominent dark nuchal blotches.

Type Locality.—Mexico.

Range.—This snake occurs in the United States in Arizona, New Mexico and western Texas. Thence it ranges south through Mexico to Guatemala. In Arizona it has been found in the plateau region and about the foothills of various mountain groups. Ruthven has recorded it from Fort Apache, Fort Huachuca, White River Canyon, Sabino Canyon, and Fort Whipple, Arizona.

We have examined specimens from the following localities:

1. Cave Creek, Maricopa Co., Arizona.
2. Oak Creek, Coconino Co., Ariz.
3. Sabino Canyon, Santa Catalina Mountains, Pima Co., Ariz.
4. Steam pump, foothills of the Catalina Mountains, 18 miles north of Tucson, Pima Co., Ariz.

Material.—Twenty-one specimens from these four localities.

Variation.—The loreals are 1—1 in all. The preoculars are 1—1 in all but one which has 1—2. The postoculars are 3—3 in all but three which have 3—4. The temporals are 1+2—1+2 in fourteen, 1+2—1+3 in three, 1+3—1+3 in three, and 2+3—2+3 in one. The supralabials are 8—8 in twenty, and 8—9 in one. The infralabials are 10—10 in seventeen, 11—11 in two, 10—11 in one, and 9—10 in one. The scale-rows are 19—19—17 in all but one which has 21—19—17. The gastrosteges vary in number from 164 to 175, males having from 166 to 175, females from 164 to 171; the average in thirteen males is 170.6, in seven females, 168. The urosteges vary from 77 to 97, males having from 85 to 97, females from 77 to 88; the average in twelve males is 91.7, in six females, 83.5.

The series is too small to show the real limits of variation. The scale-counts are given in full in the following table.

Number	Sex	Sca e rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Local-ity
17543	♀	19— 17	164	82	8—8	10—10	1—1	3—3	1—1	1+2—1+2	1
17544	♂	19—17	172	47+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	1
17545	♂	19—17	172	93	8—9	11—11	1—1	3—3	1—1	1+3—1+3	1
34169	♀	19—17	167	77	8—8	10—10	1—1	3—4	1—1	1+2—1+2	3
34170	♂	19—17	167	85	8—8	10—10	1—2	3—3	1—1	1+3—1+3	3
34277	♂	19—17	167	97	8—8	10—10	1—1	3—3	1—1	1+2—1+3	4
34278	♂	19—17	174	93	8—8	10—10	1—1	3—3	1—1	1+2—1+2	4
34279	♀	19—17	171	80	8—8	10—10	1—1	3—3	1—1	2+3—2+3	4
34280	♂	19—17	173	87	8—8	10—10	1—1	3—3	1—1	1+2—1+2	4
34281	♀	19—17	166	55+	8—9	10—10	1—1	3—3	1—1	1+3—1+3	4
34282	♂	19—17	166	48+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	4
35256	♂	19—17	...	92	8—8	10—10	1—1	3—3	1—1	1+2—1+3	2
35257	♂	19—17	170	90	8—8	10—10	1—1	3—3	1—1	1+2—1+2	2
35258	♂	21—19—17	166	88	8—8	10—10	1—1	3—3	1—1	1+2—1+2	2
35259	♂	19—17	173	96	8—8	10—10	1—1	2—2	1—1	1+2—1+2	2
35260	♂	19—17	175	92	8—8	9—10	1—1	3—4	1—1	1+2—1+2	2
35261	♀	19—17	168	88	8—8	10—11	1—1	3—3	1—1	1+2—1+2	2
35262	♀	19—17	170	88	8—8	10—10	1—1	3—4	1—1	1+2—1+2	2
35263	♂	19—17	172	97	8—8	10—10	1—1	3—3	1—1	1+2—1+2	2
35264	♂	19—17	171	91	8—8	10—10	1—1	3—3	1—1	1+2—1+2	2
35265	♀	19—17	170	86	8—8	11—11	1—1	3—3	1—1	1+2—1+3	2

Remarks.—Specimens from Mexico and Central America seem to differ from those from Arizona and New Mexico in the frequent reduction in the number of supralabials to seven. Since our material is all from Arizona we are unable to form an opinion as to whether the snakes from these distant localities are really identical in other respects.

THE ELEGANS GROUP

The second great group of our garter-snakes includes all those snakes which show an apparent relationship with the form which Baird and Girard named *Eutainia elegans*. The satisfactory classification of the snakes which group themselves about this central form long has been regarded as one of the most difficult problems in North American herpetology. Only the large material at hand has induced us to study this problem again. The difficulties are such that we shall feel that the very great labor involved has been justified if even a little better understanding of the facts result from this study.

As a result of former study of this group five species and subspecies were recognized, as follows:—

1. *T. leptocephala* (or *ordinoides*), a dwarf form from the coast region of Washington and Oregon.

2. *T. elegans,* a striped form, from the coast and Sierra Nevada of California.

3. *T. vagrans,* a spotted form, from both sides of the Sierra Nevada and a vast country farther east.

4. *T. vagrans biscutatus,* a subspecies with an increased number of preoculars, from the Klamath Lake region and the Pacific Northwest.

5. *T. hammondii,* a form without dorsal light line, from the San Diegan Fauna and the San Joaquin Valley.

Brown, in 1903, adopted these views and recognized these same forms, but reduced *elegans* and *vagrans* to subspecific rank, and regarded *leptocephala* as a subspecies of *sirtalis* which ranged along the coast south to San Francisco.

Ruthven, in 1908, divided the snakes which, in "The Reptiles of the Pacific Coast," had been called *T. elegans,* into two groups, those from the coast and those from the Sierra Nevada. Following Brown, he united the former with *leptocephala* under the name *T. ordinoides.* The snakes from the Sierra Nevada, together with the forms *T. vagrans* and *T. vagrans biscutatus,* were merged by him in a single subspecies under the name *T. ordinoides elegans. T. hammondii* was recognized by Ruthven.

General Discussion

Before proceeding to set forth in detail the results of the present investigation, it may be well to state that the views maintained in 1897 have been, in the main, confirmed. The five forms then recognized, are still recognized, with the same limits, except that the forms then called *T. elegans* and *T. hammondii* are each divided into two, and all of the forms are reduced to subspecific rank.

Each of these subspecies occupies its own particular geographic area, where it alone represents the group; but the area occupied by each meets or overlaps that of one or more of the other members of the group. Thus, *T. ordinoides vagrans* is the only garter-snake of the *elegans* type throughout a vast area, where it adheres to its particular color characters with remarkable constancy, but in various places in the far west its range meets or overlaps the ranges of other forms and at these points specimens are found in which the instability of these same characters is quite as notable. Such specimens may defy definite subspecific identification. They are to be regarded as showing intergradation between the subspecies. All of the subspecies recognized are linked one to another by such intergradation.

Some conclusions reached from the present study are:—

1. *T. ordinoides ordinoides* is the most distinct of these subspecies.

2. The range of *T. ordinoides ordinoides* is the coast region of British Columbia, Washington and Oregon. In California it is limited to the extreme northwestern corner of the state. We are unable to follow Brown in referring to *T. ordinoides ordinoides* the snakes of the coastal strip of California; or Ruthven, in extending the range of this form south to Tehachapi and east to the Sierra Nevada.

3. The garter-snakes of the immediate coast region of California represent a distinct race or subspecies.

4. This race may be called *T. ordinoides atratus.*

5. Intergradation between *T. ordinoides ordinoides* and *T. ordinoides atratus* occurs in Del Norte and Humboldt counties.

6. *T. ordinoides atratus* is more closely related to *T. ordinoides elegans* than to the other subspecies.

7. *T. ordinoides elegans* is confined to the Sierra Nevada and the mountains of southern California, excluding the lower levels.

8. *T. ordinoides elegans* in the mountains of southern California remains true to type. No specimens showing signs of intergradation have been taken.

9. In the Sierra Nevada, however, intergradation occurs and one may be in doubt whether to refer a particular specimen to *elegans* or to *vagrans* or *couchii*.

10. The Sierra Nevada snakes of pure *elegans* type seem not to occur at the lower altitudes, but material is insufficient for proof.

11. The snakes from the lower Sierra Nevada and the San Joaquin Valley, which have been referred sometimes to *vagrans*, sometimes to *hammondii*, are neither.

12. They combine characters of both *vagrans* and *hammondii* in varying proportion.

13. They may best be regarded as a separate, though intermediate, subspecies.

14. This may be called *T. ordinoides couchii*.

15. The range or *T. o. couchii* extends from Shasta County south through the San Joaquin Valley, and, east of the Sierra Nevada, from Owen's Lake to Lake Tahoe, and Pyramid Lake.

16. Snakes of this type occur also in the warmer parts of Monterey County.

17. *Thamnophis ordinoides hammondii*, of pure type, ranges north to the Mohave River and to southern San Luis Obispo County.

18. *T. o. hammondii* may have a nuchal spot, put has no dorsal line, not even a rudimentary one.

19. In the mountains of southern California *elegans* and *hammondii* may be found together; but only *hammondii* has been taken at lower altitudes.

20. No intergradation between *hammondii* and *elegans* has been found in southern California.

21. Farther north such intergradation occurs through *couchii*.

22. The snakes of the Klamath and Modoc region usually have more than one preocular.

23. They should be recognized as a separate subspecies, ***Thamnophis ordinoides biscutatus.***

24. In coloration ***biscutatus*** is intermediate between *elegans* and ***vagrans,*** but more like ***vagrans.***

25. Snakes of the ***vagrans*** type reach the coast, or nearly there, in British Columbia and northern Washington and in southern Oregon and Del Norte County, California.

26. Since a majority of these snakes have two preoculars, it seems best to call these also ***biscutatus,*** as was done in "The Reptiles of the Pacific Coast."

27. Two snakes from the San Pedro Martir Mountains, Lower California, Mexico, which were formerly recorded as ***hammondii*** (Proc. Cal. Acad. Sci., Ser. 2, Vol. V. p. 1007) are typical ***vagrans.***

We are thus led to the recognition of eight members of the ***elegans*** group of garter-snakes, as follows:—

1. Thamnophis ordinoides ordinoides
2. Thamnophis ordinoides atratus
3. Thamnophis ordinoides elegans
4. Thamnophis ordinoides biscutatus
5. Thamnophis ordinoides vagrans
6. Thamnophis ordinoides couchii.
7. Thamnophis ordinoides hammondii
8. Thamnophis marcianus

The curves of scale-counts shown in Figures 2 to 6 will serve to show the differences and relationships of these subspecies as regards these characters. The curves show the percentage of specimens having each number of scales. Each subspecies is represented by a separate line. In all these charts the

(1) line of crosses represents,	***ordinoides***
(2) continuous line,	***atratus***
(3) dotted line,	*biscutatus* (Klamath Lake)
(4) broken line with longest segments,	***elegans*** (Sierra Nevada)
(5) broken line with shortest segments,	***elegans*** (San Bernardino Mts.)
(6) broken line with intermediate segments,	***vagrans*** (Utah, Idaho, Nevada)
(7) line of oooooooooooooo,	***hammondii***
(8) line of vvvvvvvvvvvvvv,	***couchii***

These charts represent the counts in about 262 specimens of *T. o. ordinoides,* 387 of *T. o. atratus,* 37 *T. o. elegans* from the Sierra Nevada and 41 from the San Bernardino mountains, 108 *T. o. vagrans,* 235 *T. o. biscutatus,* 75 *T. o. hammondii,* and 40 *T. o. couchii.* The numbers vary slightly for the different charts. The chart of gastrostege counts, however, is based upon smaller numbers, since it includes only male specimens.

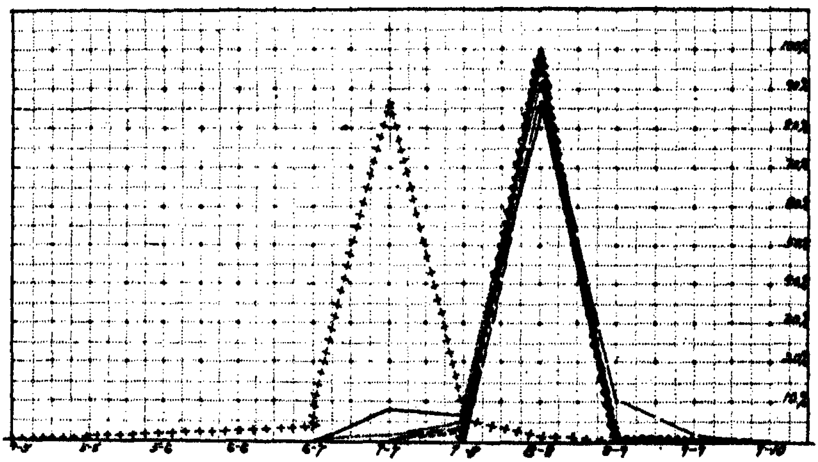


Figure 2

Figure 2 shows the counts of the supralabial plates. It brings out very clearly the distinctness of *T. ordinoides ordinoides* from all the other subspecies. The percentages shown for the various subspecies are:

T. ordinoides 0.4, 2, 4, 86, 6, 2.
T. o. atratus 8, 7, 85, 0.3, 0.3.
T. o. elegans (Sierra Nevada) 86, 11, 3.
T. o. elegans (San Bernardino Mts.) 3, 97.
T. o. vagrans 3, 96, 1.
T. o. biscutatus 2, 5, 92, 1.
T. o. hammondii 99, 1.
T. o. couchii 100.

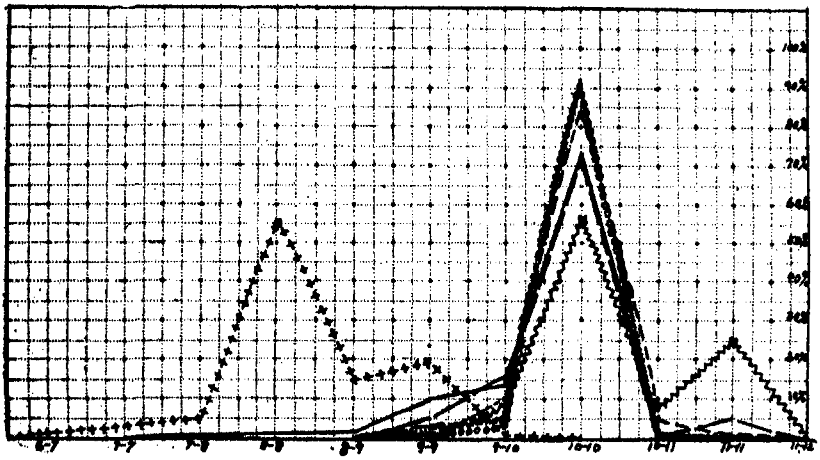


Figure 3

Figure 3 shows the counts of the infralabial plates. It again emphasizes the distinctness of *T. o. ordinoides,* and also shows the strong tendency in *T. o. couchii* to increase to 11 the number of these plates. The percentages shown for the various subspecies are:

T. o. ordinoides 1, 3, 5, 55, 15, 19, 2.
T. o. atratus 1, 2, 10, 14, 73, 1.
T. o. elegans (Sierra Nevada) 5, 17, 74, 0.4.
T. o. elegans (San Bernardino Mts.) 10, 90.
T. o. vagrans 3, 6, 84, 5, 2.
T. o. biscutatus 3, 5, 91, 1.
T. o. hammondii 3, 4, 92, 1.
T. o. couchii 7.5, 56, 7.5, 25.

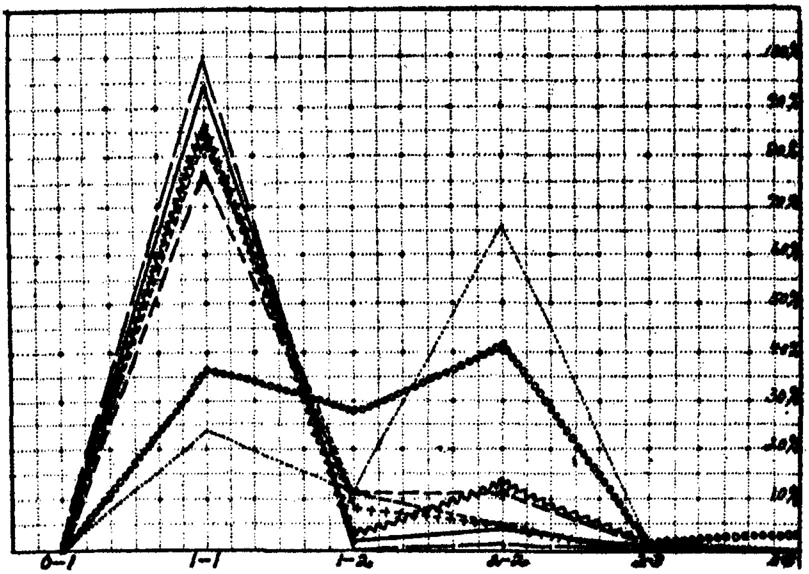


Figure 4

Figure 4 represents the number of preocular plates. It shows *T. o. biscutatus* is entitled to recognition, and that *T. o. hammondii* also has a strong tendency toward an increase in the number of these plates. The other subspecies all agree in having but one preocular as the normal condition. The percentages shown for the various subspecies are:—

T. o. ordinoides 87, 8, 5.
T. o. atratus 94, 2, 4, 0.3.
T. o. elegans (Sierra Nevada) 97, 0.3.
T. o. elegans (San Bernardino Mts.) 34, 12, 5.
T. o. vagrans 77, 11, 11, 1.
T. o. biscutatus 23, 11, 66, 0.4.
T. o. hammondii 36, 18, 42, 1, 3.
T. o. couchii 85, 2.5, 12.5.

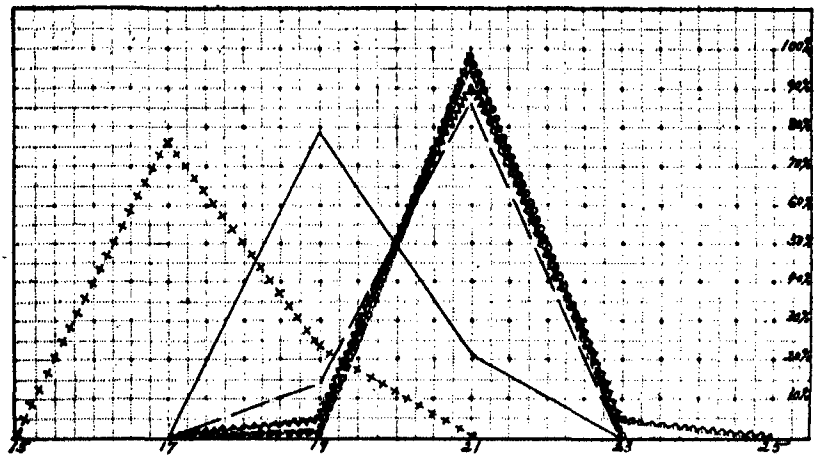


Figure 5

Figure 5 represents the greatest number of scale-rows. It shows that all of the subspecies except *T. o. ordinoides* and *T. o. atratus* agree in having normally 21 rows of scales. It indicates the right of *T. o. atratus* to recognition as a subspecies distinct from *T. o. ordinoides* on the one hand and from all of the other subspecies on the other. The percentages shown for the various subspecies are:—

T. o. ordinoides 76, 24.
T. o. atratus 79, 21.
T. o. elegans (Sierra Nevada) 13, 87.
T. o. elegans (San Bernardino Mts.) 5, 95.
T. o. vagrans 2, 98.
T. o. biscutatus 1, 95, 4.
T. o. hammondii 1, 99.
T. o. couchii 5, 90, 5.

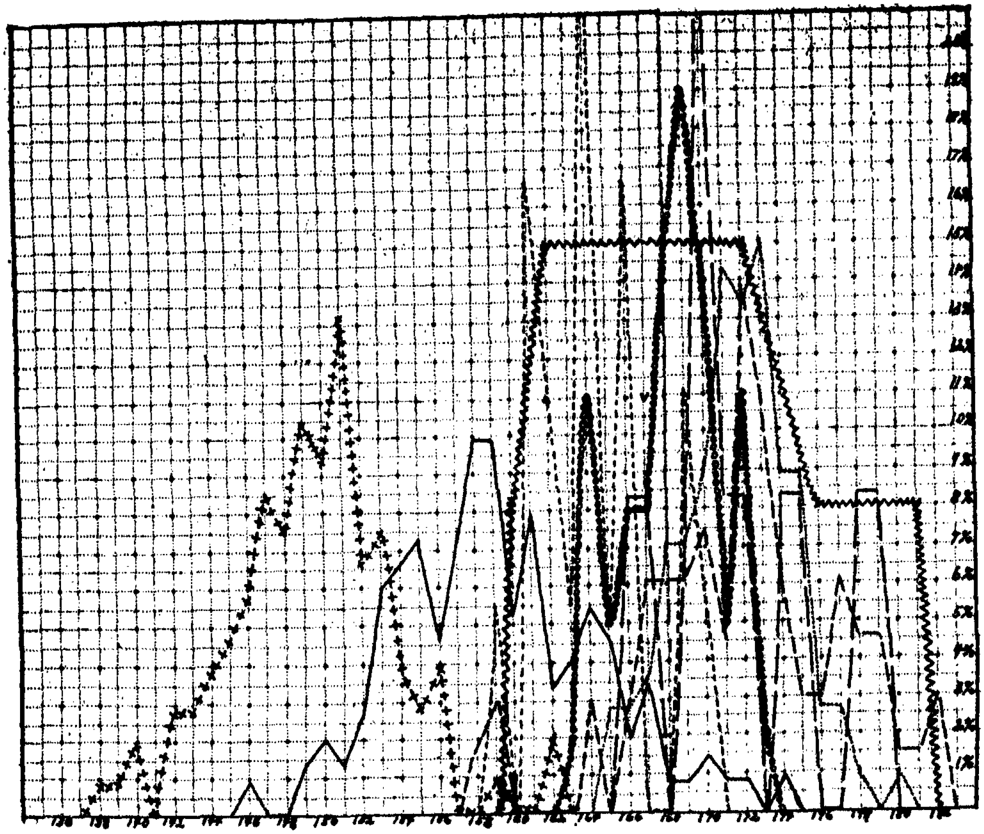
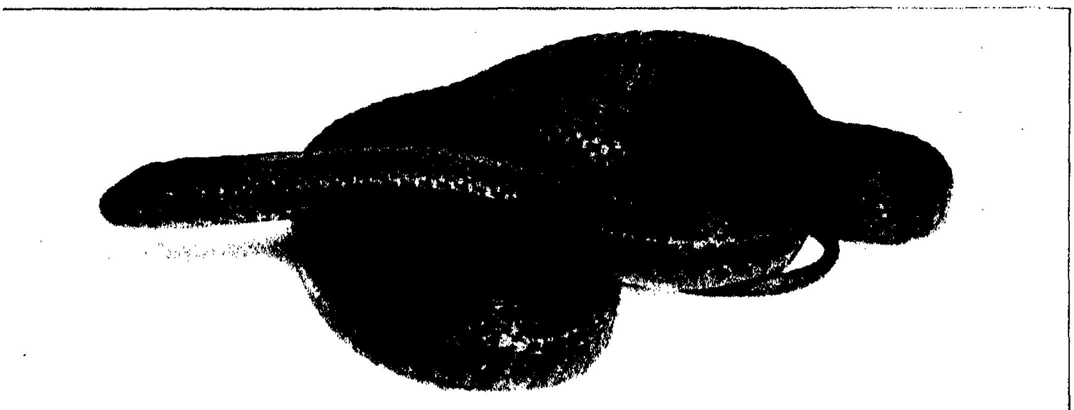


Figure 6

Figure 6 represents the variation in the number of gastrosteges, in males only. It shows that *T. o. atratus* differs from both *T. o. ordinoides* and *T. o. elegans*. All of the other races agree closely with *T. o. elegans* in the number of their gastrosteges. *T. o. ordinoides* is very distinct from all except the intermediate *T. o. atratus*.



Thamnophis ordinoides ordinoides, Puget Garter-Snake:—Photograph from living specimen collected at Portland, Oregon, in October, 1916.

Thamnophis ordinoides ordinoides (Baird & Girard)

Puget Garter-Snake.

Diagnosis.—Normally with fewer than eight supralabials and fewer than ten infralabials. Scales usually in seventeen, sometimes in nineteen, rows. Gastrosteges fewer than in the more southern races. Coloration very variable, striped, spotted or unicolor, often with some red. Preoculars usually single. Size small.

Type Locality.—Puget Sound.

Synonyms.—*Eutænia leptocephala* Baird & Girard, 1853; type locality, Puget Sound. *Eutænia cooperi* Kennicott, 1860; type localities Cathapoot'l and Willopah valleys. *Thamnophis rubristriata* Meek, 1899; type locality Olympic Mountains, Washington. *Thamnophis leptocephalus olympia* Meek, 1899; type locality Olympic Mountains, Washington.

Range.—This garter-snake seems nowhere to range far from the coast. It occurs in southwestern British Columbia, on the mainland and on Vancouver Island, and ranges thence south across Washington and Oregon to the northwestern corner of California, where it seems to be confined to Del Norte County.

We have examined specimens from the following localities:—

1. Lillooet River Valley, British Columbia.
2. Friendly Cove, Nootka Sound, B. C.
3. Golden Eagle Mine, Mt. Saunders, B. C.
4. Tahsis Canal, Nootka Sound, B. C.
5. Alberni Valley, Vancouver Island, B. C.
6. San Juan Islands, Washington.
7. New Whatcom, Wash.
8. Port Orchard, Kitsap Co., Wash.
9. Darrington, Snohomish Co., Wash.
10. Montesano, Chehalis Co., Wash.
11. Melbourne, Chehalis Co., Wash.
12. Pierce Co., Wash.
13. Lebam, Pacific Co., Wash.
14. Trapp Creek, Pacific Co., Wash.
15. Astoria, Clatsop Co., Oregon.

16. Gearheart, Clatsop Co., Ore.
17. Portland, Multnomah Co., Ore.
18. Garibaldi, Tillamook Co., Ore.
19. Trask River, Tillamook Co., Ore.
20. Tillamook, Tillamook Co., Ore.
21. Nestucea River Road, Tillamook Co., Ore.
22. Road to Nestucea between Grandronde and Dolph, Yamhill Co., Ore.
23. Siletz, Lincoln Co., Ore.
24. Toledo, Lincoln Co., Ore.
25. Junction Little Elk and Yaquina River, Benton Co., Ore.
26. Between Chitwood and Siletz River, Benton Co., Ore.
27. Road between Pioneer and Siletz River, Benton Co., Ore.
28. Philomath, Benton Co., Ore.
29. Alsea River, near Alsea, Benton Co., Ore.
30. Junction Lake and Deadwood Creek, Lane Co., Ore.
31. Junction of Siuslaw River and Lake Creek, Lane Co., Ore.
32. Elmira, Lane Co., Ore.
33. Marshfield, Coos Co., Ore.
34. South Fork Coos River, Coos Co., Ore.
35. Sumner, Coos Co., Ore.
36. Coquille, Coos Co., Ore.
37. South Fork Coquille River, 20 miles above Myrtle Point, Coos Co., Ore.
38. Myrtle Point, Coos Co., Ore.
39. Camas Mountains, Douglas Co., Ore.
40. Sixes River, Curry Co., Ore.
41. Port Orford, Curry Co., Ore.
42. Elk Creek, Curry Co., Ore.
43. Flores Creek, Curry Co., Ore.
44. Between Flores Creek and Rogue River, Curry Co., Ore.
45. Vicinity mouth of Rogue River, Curry Co., Ore.
46. Corbin, Curry Co., Ore.
47. Goldbeach, Curry Co., Ore.
48. Harbor, Curry Co., Ore.
49. Smith River, Del Norte Co., California.
50. Gasquet, Del Norte Co., Cal.
51. Crescent City, Del Norte Co., Cal.

52. Requa, Del Norte Co., Cal.
53. Union Bay, Bayne Sound, B. C.
54. Mt. Rainier, Pierce Co., Wash.
55. Drain, Douglas Co., Ore.
56. Cow Creek, Douglas Co., Ore.

Material.—About three hundred and twenty-five snakes of this subspecies have been examined by us in the preparation of this paper.

Variation.—Three specimens have no loreal plates; one has a loreal on one side only; the others have the normal loreal 1—1. The preoculars are 1—1 in two hundred and seventy-nine, or 86%; 1—2 in twenty-six, or 8%; and 2—2 in twenty, or 6%. The postoculars are 3—3 in two hundred and eighty-four, or 87%; 2—3 in twenty-four, or 7%; 2—2 in sixteen, or 5%; and 1—2 in one. The temporals are 1+2—1+2 in two hundred and eighty-nine, or 89%; 1+2—1+1 in eighteen, or 6%; 1+2—1+3 in eight, or 2%; 1+1—1+1 in four, or 1%; and 3+3—3+3 in three, or 1%. The supralabials are 7—7 in two hundred and eighty-three, or 85%; 7—8 in twenty, or 6%; 7—6 in nine, or 3%; 8—8 in five, or 2%; 6—6 in four, or 1%; 5—5 in one, and 8—6 in one. The infralabials are 8—8 in one hundred and seventy-nine, or 55%; 8—9 in fifty-eight, or 18%; 8—9 in fifty-four, or 17%; 7—8 in sixteen, or 5%; 7—7 in nine, or 3%; 9—10 in six, or 2%; and 6—7 in two. The scale-rows are 17—17—15 or 17—15—15 in two hundred and thirty-six, or 72%; the other 28% all have 19 rows, but the formula may be 17—19—17—15, 17—19—17, 19—19—17, 19—19—15, 17—19—17, or 17—18—19—17. The gastrosteges vary in number from 135 to 162, males having from 138 to 162, females from 135 to 154; the average in one hundred and eighteen males is 149.2, in one hundred and fifty-eight females, 144.8. The urosteges vary from 50 to 81, males having from 56 to 81, females from 50 to 72; the average in ninety-six males is 70.2, in one hundred and twenty-eight females, 60.9.

This variation is shown in full in the following table of scale-counts.

Scale counts in *Thamnophis ordinoides ordinoides*

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Locality
85170	♀	17—19—17—15	148	59c	7—7	9—8	1—1	3—2	1—1	1+3——1+3	1
C2466	♀	17—17—15	142	58c	7—8	9—10	2—1	3—3	1—1	1+2——1+2	2
C2468	♀	17—17—15	141	58c	7—7	8—9	1—1	3—3	1—1	1+2——1+3	3
C2469	♀	17—17—15	145	63c	7—7	9—9	1—1	2—2	1—1	1+2+2—1+2+1	4
C2470	♀	17—17—15	145	62c	7—7	9—9	2—2	3—3	1—1	1+2——1+3	4
C2296	♀	17—19—15	143	56c	7—7	8—7	1—1	3—3	1—1	1+2——1+2	5
C2299	♀	17—19—15	144	49+	7—8	9—10	2—2	3—3	1—1	1+2——1+2	5
C2308	♀	17—17—15	143	58c	6—7	7—8	1—1	3—3	1—1	1+2——1+2	5
C2309	♀	17—17—15	141	61c	7—7	9—9	1—1	3—3	1—1	1+2——1+2	5
C2310	♀	17—17—15	152	58c	7—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2	5
C2311	♀	17—17—15	140	55c	7—7	8—9	1—1	3—3	1—1	1+3——1+3	5
C2312	♀	17—17—15	146	57c	7—7	8—8	2—2	3—3	1—1	1+2——1+2	5
C2313	♀	17—17—15	147	60c	7—7	8—9	2—2	3—3	1—1	1+2——1+2	5
C2467	♀	17—17—15	141	58c	7—7	9—9	1—1	3—3	1—1	1+2——1+2	5
86515	♀	17—19—17—15	142	56c	8—7	8—8	1—1	3—3	1—1	1+2——1+2	6
84269	♂	17—17—17—15	156	67c	7—7	8—8	1—1	3—3	1—1	1+2——1—2	7
30400	♂	17-18-19-19-17	148	71c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	8
30508	♀	17—17—15	143	56c	7—7	9—9	1—1	3—3	1—1	1+2+1—1+2+1	9
30511	♀	17—17—15	149	47+	6—7	9—9	1—1	3—3	1—1	1+2——1+2	9
24101	♂	17—17—15	151	68c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	10
24102	♀	17—19—15	147	58c	7—7	7—7	1—1	3—3	1—1	1+2——1+2	10
24103	♀	17—19—15	150	59c	7—7	8—8	1—1	3—3	1—1	1+2+1—1+2+2	10
29930	♂	17—17—15	146	66c	7—7	9—8	1—1	3—3	1—1	1+2+2—1+2+2	11
29931	♀	17—19—17—15	144	63c	7—7	8—8	1—1	3—3	1—1	1+2——1+2+2	11
29932	♂	17—19—17—15	149	64c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	11
29933	♀	17—17—15	146	61c	8—6	8—8	1—1	3—3	1—1	1+2+2—1+2+2	11
29934	♀	17—19—17—15	148	58c	7—7	8—8	1—1	3—3	1—1	1+2——1+1	11
29935	♀	17—17—15	142	37+	7—7	8—8	1—1	3—3	1—1	1+3+2—1+2+2	11
29936	♀	17—19—17—15	143	48+	7—7	8—8	1—1	3—3	1—1	1+2——1+2	11
29937	♂	17—17—15	149	62c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	11
29938	♂	17—17—15	145	64c	6—7	8—9	1—1	3—3	1—1	1+2+2—1+2+2	11
29939	♀	19—19—17	145	63c	7—7	9—9	1—1	3—3	1—1	1+2——1+3	11
29940	♂	17—17—15	145	39+	7—7	8—8	1—1	3—3	1—1	1+2+1—1+1+1	11
85152	♂	17—17—15—15	150	64c	7—7	8—8	1—1	3—3	1—1	1+2——1+2	12
85153	♀	17—17—15—15	143	48+	7—7	9—9	1—1	2—2	1—1	1+2——1+2	12
29922	♂	17—19—17—15	147	62+	7—7	8—8	2—1	3—3	1—1	1+2+2—1+2+2	13
29923	♀	17—17—15	149	60c	7—7	8—8	1—1	3—3	1—1	1+2+3—1+2+3	14
29924	♂	17—19—17—15	146	72c	7—7	8—8	2—1	3—3	1—1	1+2+1—1+2+1	14
29925	♂	17—19—17—15	146	57+	7—7	9—8	1—1	3—3	1—1	1+2+2—1+2+1	14
29926	♀	17—19—17—15	147	53+	7—7	9—9	1—2	3—3	1—1	1+2+2—1+2+2	14
29862	♀	17—17—15	145	59c	7—7	7—7	1—1	3—3	1—1	1+2+2—1+2+2	15
29863	♂	17—17—15	149	69c	8—7	8—8	1—1	3—3	1—1	1+2+1—1+2+2	15
29864	♂	17—17—15	155	66c	7—7	7—7	1—1	3—3	1—1	1+2+2—1+2+2	15
29865	♂	17—17—15	147	62c	7—7	8—7	2—2	3—3	1—1	1+2+2—1+2+2	15
29866	♀	17—17—15	144	48+	7—8	9—9	1—1	3—3	1—1	1+3+2—1+2+1	15
29867	♂	17—17—15	151	68c	7—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2	15
29868	♂	17—17—15	149	65c	7—7	7—8	1—1	3—3	1—1	1+2+2—1+2+2	15
29869	♀	17—19—15	145	61c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	15
29810	♀	17—17—15	147	27+	7—7	7—8	1—1	3—3	1—1	1+2+2—1+2+2	16
29811	♂	17—17—15	150	51+	7—7	8—8	1—1	3—3	1—1	1+1——1+2	16
20401	♂	17—17—15	152	73c	6—7	7—8	1—1	2—2	1—1	1+2——1+2	17
20402	♀	17—17—15	153	64c	7—7	8—8	1—1	2—2	1—1	1+2+2—1+2+2	17
20403	♂	17—17—15	152	71c	7—8	8—8	1—1	3—3	1—1	1+2+2—1+2+2	17
20404	♂	17—19—15	149	76c	7—7	8—8	1—1	2—3	1—1	1+2+2—1+2+2	17
20405	♂	17—17—15	151	67+	7—7	8—9	1—1	3—3	1—1	1+2+2—1+2+2	17
20406	♀	17—19—17	147	64c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	17
20407	♀	17—17—15	142	63c	7—7	8—8	1—1	3—2	1—1	1+2——1+2	17
20408	♀	17—19—17	152	64c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	17
20409	♀	17—17—15	146	51+	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	17
20410	♂	17—19—15	148	72c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	17
20411	♂	17—17—15	150	70c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	17
29711	♀	17—17—15	152	63c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	18
29712	♀	17—17—15	147	50c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	18
29713	♀	17—19—15	144	57c	7—8	8—8	1—1	3—3	1—1	1+2+2—1+2+2	18
29714	♀	17—17—15	154	42+	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	18
29742	♀	17—17—15	151	58c	6—6	8—8	1—1	3—3	1—1	1+2+2—1+2+2	19
29743	♀	17—17—15	145	60c	7—7	9—8	1—1	3—3	1—1	1+2+2—1+2+2	19
29688	♂	17—17—15	146	62c	7—8	10—9	1—1	3—3	1—1	1+2+2—1+2+2	20
29689	♂	17—17—15	154	63c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+1+2	20
29690	♂	17—17—15	152	72c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	20
29691	♀	17—17—15	148	36+	7—7	8—8	1—1	3—3	0—0	1+2+2—1+2+2	20
29692	♀	17—17—15	144	59c	7—7	9—8	1—1	3—3	1—1	1+2+2—1+1+2	20
29693	♂	17—17—15	148	70+	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	20
29694	♀	17—19—17	148	56c	6—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	20
29695	♂	17—17—15	154	71+	7—7	8—8	1—1	3—3	1—1	1+3+2—1+2+2	20

Scale counts in *Thamnophis ordinoides ordinoides*—Continued

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Local-ity
29697	♀	17—17—15	152	62c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	20
84534	♂	17—19—17—15	152	56c	7—7	9—9	1—1	3—3	1—1	1+2——1+2	21
85308	♂	17—17—17—15	144	65c	7—7	8—8	2—2	2—2	1—1	1+2——1+2	22
29687	♂	17—17—15	153	67c	7—7	8—8	1—1	2—2	1—1	1+2+2—1+2+2	23
29643	♂	17—17—15	148	62c	7—7	8—8	2—1	3—3	1—1	1+2+2—1+2+2	24
29644	♀	17—17—15	148	58c	7—7	8—8	1—1	3—2	1—1	1+2+2—1+2+2	24
29645	♂	17—17—15	153	67c	7—7	9—8	1—1	2—2	1—1	1+2+2—1+2+1	24
29646	♂	17—17—15	147	67c	7—7	9—9	1—1	3—3	1—1	1+1+2—1+2+2	24
29647	♂	17—17—15	151	63c	7—7	8—8	1—1	3—3	1—1	1+2——1+2	24
29648	♂	17—17—15	153	66c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	24
29649	♀	17—17—15	145	59c	7—6	6—7	1—1	3—3	1—1	1+1+2—1+1+2	24
29650	♂	17—17—15	151	67c	7—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2	24
29651	♂	17—17—15	146	60c	7—7	8—8	1—1	2—3	1—1	1+2+2—1+2+2	24
29652	♀	17—17—15	144	61c	7—7	8—9	1—1	3—3	1—1	1+1——1+2+2	24
29653	♀	19—19—17	147	56c	8—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2	24
29654	♀	17—17—15	147	59c	7—7	8—8	1—1	2—3	1—1	1+2+2—1+2+2	24
29655	♂	17—17—15	148	69c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	24
29656	♂	17—17—15	151	67c	7—7	8—8	1—1	3—3	1—1	1+1+2—1+2+2	24
29657	♀	17—17—15	149	64c	7—7	8—8	1—1	3—3	1—1	1+1——1+1	24
29658	♂	17—17—15	148	17+	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	24
29659	♂	17—17—15	150	61+	7—7	9—8	1—1	3—3	1—1	1+2+2—1+2+2	24
29660	♂	17—17—15	147	67c	7—7	8—8	1—1	3—3	0—1	1+2——1+2	24
29661	♀	17—19—15	144	59c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	24
29662	♀	17—17—15	149	60c	7—8	9—9	1—1	3—3	1—1	1+2——1+2	24
29663	♂	17—17—15	151	18+	7—7	9—8	1—1	3—3	1—1	1+2+2—1+2+2	24
29664	♂	17—17—15	150	66c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	24
29665	♀	17—17—15	149	57c	7—7	9—8	1—1	3—3	1—1	1+2+2—1+2+2	24
29666	♂	17—17—15	153	55+	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	24
29667	♂	17—17—15	150	72c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	24
29668	♂	19—19—15	152	68c	7—7	8—9	1—1	3—3	1—1	1+2+2—1+2+2	24
29669	♂	17—17—15	154	74c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	24
29670	♂	17—17—15	153	28+	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	24
29671	♂	17—17—15	148	50+	7—7	7—8	1—1	2—3	1—1	1+2+2—1+2+2	24
29672	♀	17—17—15	152	57c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	24
29673	♀	17—17—15	147	24+	7—7	8—8	1—1	3—3	1—1	1+2——1+2	24
29674	♀	17—17—15	151	63c	7—7	8—8	1—1	2—2	1—1	1+2+2—1+2+2	24
29675	♀	17—17—15	148	37+	7—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2	24
29676	♀	17—17—15	149	58c	7—7	8—8	1—1	3—3	1—1	1+2——1+2	24
29677	♀	17—17—15	150	58c	7—7	8—9	1—1	3—3	1—1	1+2+2—1+2+2	24
29678	♀	19—19—17	144	64c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	24
84506	♂	17—17—15—15	148	65c	7—7	8—8	1—1	3—3	1—1	1+2——1+2	25
84507	♀	17—19—17—15	154	63c	7—7	8—8	1—1	2—3	1—1	1+2——1+2	25
84508	♀	17—17—17—15	143	58+	7—7	8—8	1—1	3—3	1—1	1+1——1+2	25
84509	♀	19—19—17—15	153	58c	7—7	8—8	1—1	3—3	1—1	1+2——1+2	25
84510	♂	17—17—17—15	153	69c	7—7	8—8	1—1	3—3	1—1	1+2——1+2	25
84511	♀	17—17—17—15	146	37+	7—7	8—8	1—1	3—3	1—1	1+2——1+2	25
84528	♂	17—19—17—15	148	72c	7—7	9—8	1—1	3—3	1—1	1+2——1+2	26
84529	♂	17—17—17—15	149	67c	7—7	8—8	2—2	3—3	1—1	1+2——1+2	26
84530	♀	17—19—17—15	151	55+	7—7	9—8	1—1	3—3	1—1	1+2——1+2	26
84531	♂	17—17—15—15	151	67c	8—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	26
84532	♀	17—19—17—15	144	45+	7—7	8—8	1—1	3—3	1—1	1+2——1+2	26
84514	♀	17—19—17—15	152	63c	7—7	8—8	1—1	2—3	1—1	1+2——1+2	26
84515	♀	17—19—17—15	152	56c	7—7	8—8	1—1	3—3	1—1	1+2——1+2	26
84516	♀	17—17—17—15	149	60c	7—7	8—8	1—1	3—3	1—1	1+2——1+2	26
84517	♀	17—19—17—15	154	60c	7—6	9—10	1—1	3—3	1—1	1+2——1+2	26
84518	♀	17—19—17—15	151	58c	7—7	8—8	1—1	3—3	1—1	1+2——1+2	26
84519	♀	17—17—17—15	145	63c	8—8	9—9	1—1	3—3	1—1	1+2——1+2	26
84520	♀	19—19—17—15	152	58c	7—7	9—8	1—1	3—3	1—1	1+2——1+2	26
84521	♀	17—19—17—15	145	60c	7—7	9—8	1—1	3—3	1—1	1+2——1+2	26
84522	♀	17—17—15—15	151	61c	7—7	8—8	1—1	3—3	1—1	1+2——1+2	26
84523	♀	17—17—15—15	149	59+	7—7	8—8	1—1	3—3	1—1	1+2——1+2	26
84524	♀	17—19—17—15	154	61c	7—7	9—8	1—1	3—3	1—1	1+2——1+2	26
84525	♀	19—19—17—15	151	50+	7—8	8—9	1—2	3—3	1—1	1+2——1+2	26
84526	♀	17—19—17—15	150	63c	7—7	8—8	2—1	3—3	1—1	1+2——1+2	26
84527	♀	17—19—17—15	152	61c	7—7	8—8	1—1	3—3	1—1	1+2——1+2	26
84513	♀	17—17—17—15	148	62c	7—7	8—7	1—1	3—3	1—1	1+2——1+2	27
84427	♀	19—19—17—15	151	41+	7—7	8—8	1—1	3—3	1—1	1+2——1+2	28
84428	♂	17—19—17—15	159	72c	7—7	9—9	1—1	3—3	1—1	1+2——1+2	28
84502	♂	17—17—15—15	150	54+	7—7	8—8	2—2	3—3	1—1	1+2——1+2	29
84503	♂	17—19—17—15	153	68c	7—7	9—9	2—2	3—3	1—1	1+2——1+2	29
84505	♂	17—17—17—15	149	38+	7—7	8—8	1—1	3—3	1—1	1+2——1+2	29
84500	♂	17—19—17—15	145	73c	7—7	8—8	1—1	3—3	1—1	1+1——1+2	30
84498	♀	17—19—17—15	145	62+	7—7	9—9	1—1	3—3	1—1	1+2——1+2	31
84499	♀	17—17—17—15	146	65c	7—7	8—8	1—1	3—3	1—1	1+2——1+2	31
29626	♂	17—17—15	156	71c	7—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2	32

Scale counts in *Thamnophis ordinoides ordinoides*—Continued

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Local-ity
S4447	♀	17—19—17—15	147	63c	7—7	8—8	1—1	3—3	1—1	1+2——1+2	33
S4482	♀	17—19—17—15	142	61c	7—7	8—8	1—1	3—3	1—1	1+2——1+2	34
S4483	♀	17—17—17—15	146	61c	7—7	9—9	1—1	3—3	1—1	1+3——1+2	34
S4445	♀	17—17—15—15	146	58c	7—7	7—8	2—2	3—3	1—1	1+1——1+2	35
S4481	♀	17—17—15—15	145	72c	7—7	8—8	1—1	3—3	1—1	1+2——1+2	36
S4470	♀	17—17—15—15	148	59c	7—7	9—8	1—1	3—3	1—1	1+2——1+2	37
S4472	♀	17—17—15—15	148	59+	7—7	7—8	1—1	2—2	1—1	1+2——1+2	37
S4475	♀	17—17—15—15	148	57c	7—7	9—8	1—1	3—3	1—1	1+2——1+2	37
S4477	♂	17—17—17—15	147	67c	7—7	8—8	1—1	3—2	1—1	1+2——1+2	37
S4478	♀	17—17—15—15	148	63c	7—7	8—8	1—1	3—3	1—1	1+2——1+2	37
S4217	♀	17—19—17—15	151	35+	7—7	9—9	1—1	3—3	1—1	1+2——1+2	38
29419	♀	17—17—15	139	57c	6—6	8—8	1—1	3—3	1—1	1+2+2—1+2+2	38
29420	♂	17—17—15	153	70c	7—7	8—8	1—1	3—2	1—1	1+2+2—1+2+2	38
29421	♂	17—17—15	145	71c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	38
29422	♂	17—19—15	150	47+	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	38
29423	♂	17—17—15	151	77+	7—7	9—8	1—1	3—3	1—1	1+2+2—1+2+2	38
29424	♀	17—17—15	151	58c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	38
29425	♀	17—17—15	149	66c	7—7	8—8	1—1	3—3	1—1	1+2——1+2	38
29426	♂	17—19—15	151	71c	8—7	8—8	1—1	3—3	0—0	1+2+2—1+2+2	38
29427	♀	17—17—15	145	63c	7—7	8—9	1—2	3—3	1—1	1+2+2—1+2+2	38
29428	♀	17—17—15	149	61c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	38
29429	♂	17—17—15	144	69c	7—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2	38
29430	♀	17—17—15	144	61c	7—7	8—8	2—2	3—3	1—1	1+1——1+1	38
29431	♂	17—17—15	149	67c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+1+2	38
29432	♂	19—19—15	155	72c	7—7	8—8	1—1	3—3	1—1	1+2——1+2	38
29433	♀	17—17—15	143	56c	7—7	8—8	1—2	3—3	1—1	1+2+2—1+2+2	38
29434	♀	17—19—15	149	58c	7—7	8—8	1—1	2—2	1—1	1+2+2—1+2+2	38
29435	♀	17—17—15	145	63c	7—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2	38
29436	♂	17—17—15	152	72c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	38
29437	♂	17—17—15	147	75c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	38
29438	♀	17—17—15	142	62c	7—7	8—7	1—1	3—3	1—1	1+2+1—1+1+2	38
29439	♂	17—17—15	152	72c	7—7	7—7	2—1	3—3	1—1	1+2+2—1+2+2	38
29440	♀	17—17—15	144	60c	7—7	8—8	1—1	3—3	0—0	1+2+2—1+2+2	38
29493	♂	17—17—15	162	71c	7—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2	39
S4448	♀	17—17—17—15	143	65c	7—7	8—8	1—1	3—2	1—1	1+2——1+2	40
29375	♀	17—17—15	143	58c	7—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2	41
29376	♀	17—17—15	145	63c	7—7	9—9	1—2	3—3	1—1	1+2+2—1+2+2	41
29377	♀	?—17—15	135	64c	7—7	9—8	1—1	3—3	1—1	1+2+2—1+2+2	41
29378	♀	17—17—15	149	63c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	41
29379	♂	17—17—15	151	68c	7—7	9—9	1—1	3—3	1—1	1+1+2—1+2+2	41
29380	♀	17—17—15	140	63c	7—7	8—8	1—1	3—3	1—1	1+3——1+2	41
29381	♂	17—17—15	147	62+	6—6	8—8	1—1	3—3	1—1	1+2+2—1+2+2	41
29382	♀	17—17—15	146	65c	7—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2	41
29383	♂	17—17—15	139	66c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	41
29384	♂	17—17—15	146	72c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	41
29385	♀	17—17—15	145	70c	7—7	9—9	2—2	3—3	1—1	1+2——1+2	41
29386	♀	17—17—15	142	62c	7—7	9—8	1—1	3—3	1—1	1+2+2—1+2+2	41
29387	♀	17—17—15	139	59c	7—6	8—8	1—1	3—3	1—1	1+2+2—1+2+2	41
29388	♀	17—17—15	146	57c	7—7	8—9	1—1	3—3	1—1	1+2+3—1+2+2	41
29389	♀	17—17—15	145	57c	7—7	9—9	2—1	3—3	?—1	1+2——1+2	41
29397	♂	19—19—15	151	78+	8—8	9—9	1—1	3—3	1—1	1+2+2—1+2+2	41
S4444	♂	17—17—15—15	149	68c	7—7	8—8	1—1	3—3	1—1	1+2——1+1	42
S4452	♀	17—17—17—15	143	62c	7—7	8—8	1—1	3—3	1—1	1+2——1+2	43
S4453	♀	17—17—15—15	142	65c	7—7	8—8	1—2	3—3	1—1	1+2——1+2	43
S4454	♀	17—17—17—15	149	62c	7—7	8—8	1—1	2—3	1—1	1+2——1+2	43
S4455	♂	17—17—15—15	149	69c	7—7	8—8	1—1	3—3	1—1	1+2——1+2	43
S4456	♀	17—17—17—15	144	64c	7—7	9—8	1—1	3—3	1—1	1+1——1+2	43
S4457	♂	17—17—15—15	151	66c	7—7	8—8	1—1	3—3	1—1	1+2——1+2	44
S4458	♀	17—19—17—15	147	62c	7—7	10—9	1—1	3—3	1—1	1+2——1+2	44
S4459	♀	17—17—17—15	141	51+	6—6	8—7	1—1	3—3	1—1	1+2——1+2	44
S4460	♀	17—17—17—15	139	61c	7—7	9—9	1—1	3—3	1—1	1+2——1+2	44
S4461	♂	17—17—15—15	147	70c	6—7	8—8	1—1	3—3	1—1	1+2——1+2	44
S4462	♂	17—17—17—15	150	68c	7—7	9—8	1—1	3—3	1—1	1+2——1+2	44
S4464	♀	17—17—17—15	145	59c	7—7	9—8	1—1	3—3	1—1	1+2——1+2	44
S4465	♂	17—17—15—15	140	40+	7—7	8—8	1—1	2—3	1—1	1+2——1+2	44
S4466	♀	17—17—17—15	139	56+	7—7	8—9	1—1	2—3	1—1	1+2——1+2	44
S4467	♀	17—17—15—15	143	59c	7—8	8—8	1—1	3—3	1—1	1+2——1+2	44
S4468	♂	17—17—15—15	151	64c	7—7	8—8	2—1	3—3	1—1	1+2——1+2	44
S4436	♀	17—19—17—15	142	50+	7—7	8—8	1—1	3—3	1—1	1+2——1+2	45
29373	♀	17—17—15	139	61c	7—7	9—8	1—1	3—3	1—1	1+2——1+3	46
29366	♀	17—17—15	147	64c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+1+2	47
29268	♂	17—17—15	155	78c	7—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2	48
29269	♀	17—17—15	144	67c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	48
29270	♂	17—17—15	144	71c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	48
29271	♀	17—17—15	147	59c	7—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2	48

Scale counts in *Thamnophis ordinoides ordinoides*—Continued

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Local-ity
29272	♂	17—17—15	142	72c	7—7	8—9	1—1	3—3	1—1	1+2+2—1+2+2	48
29273	♀	17—17—15	144	41+	8—8	9—9	1—1	3—3	1—1	1+2+2—1+2+2	48
29274	♂	17—17—15	147	77c	7—7	9—8	1—1	3—3	1—1	1+2+2—1+2+2	48
29275	♂	17—17—15	151	78c	7—7	8—9	1—1	3—3	1—1	1+2+2—1+2+2	48
29276	♀	17—17—15	144	66+	7—7	8—8	2—1	3—3	1—1	1+2+2—1+2+2	48
29277	♀	17—17—15	143	65c	8—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	48
29278	♀	17—17—15	144	45+	7—7	8—8	1—1	2—3	1—1	1+2———1+2	48
29279	♀	17—17—15	145	65c	7—7	7—7	1—1	3—3	1—1	1+2———1+2	48
29213	♀	17—17—15	141	63c	5—5	6—7	1—1	2—2	1—1	1+2+2—1+2+2	49
29214	♀	17—17—15	137	60c	7—7	9—8	1—1	3—3	1—1	1+2+2—1+2+2	49
29215	♀	17—17—15	142	59c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	49
29216	♀	17—17—15	143	64c	8—8	9—9	1—2	3—3	1—1	1+2+3—1+2+2	49
S4265	♂	17—17—17—15	143	72c	8—7	9—9	1—1	3—3	1—1	1+2———1+2	50
S4267	♀	17—17—15—15	144	48+	7—7	9—9	1—1	3—3	1—1	1+2———1+2	50
S6315	♀	17—17—15—15	137	65c	7—7	8—8	1—1	2—2	1—1	1+2———1+2	51
29236	♂	17—17—15	143	73c	7—7	8—8	1—1	2—2	1—1	1+2+2—1+2+2	51
29237	♀	17—17—15	144	65c	7—7	8—8	1—1	3—2	1—1	1+2———1+2	51
29238	♀	17—15—15	151	68c	7—7	9—9	1—1	2—2	1—1	1+2+2—1+2+2	51
29239	♀	17—15—15	141	61c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	51
29240	♀	17—17—15	141	67c	7—7	8—9	1—1	3—3	1—1	1+2+2—1+2+2	51
29241	♀	17—17—15	144	60c	7—7	7—7	1—1	3—3	1—1	1+2———1+2	51
29242	♀	17—17—15	140	62c	7—7	9—10	1—1	3—3	1—1	1+2———1+2	51
29243	♂	17—17—15	142	72c	7—7	8—8	1—1	3—3	1—1	1+2+1—1+2+2	51
29244	♀	17—17—15	140	69c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	51
29245	♀	17—17—15	139	60c	7—7	8—8	1—1	2—3	1—1	1+2+2—1+2+2	51
29246	♀	17—17—15	137	58+	7—7	7—8	1—1	2—2	1—1	1+2———1+2	51
29247	♂	17—17—15	144	52+	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	51
29248	♂	17—17—15	140	38+	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	51
29249	♂	17—17—15	143	70c	7—7	7—8	1—1	3—3	1—1	1+2+2—1+2+2	51
29250	♂	17—17—15	138	65c	7—7	8—8	1—1	3—3	1—1	1+2+2—1+2+2	51
29093	♂	17—17—15	142	72c	7—7	7—7	1—1	2—1	1—1	1+2+2—1+2+2	52
29091	♀	17—17—15	148	58c	7—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2	52
S7211	♂	17—17—15	148	63c	....	....	1—1	—1	—1	1+2———1+2	53
30002	♀	17—17—15	145	64	7—7	9—9	2—1	3—3	1—1	1+2+2—1+2+2	54
29578	♀	19—19—17	154	63	7—7	9—9	1—1	3—3	1—1	1+3———1+2	55
29579	♂	17—17—15	162	77	6—7	8—8	1—1	3—3	1—1	1+2———1+2	55
S4485	♂	17—19—17—15	156	80c	7—7	9—9	2—1	3—3	1—1	1+2———1+2	56
S4486	♀	17—19—17—15	143	62c	7—7	9—9	2—1	3—3	1—1	1+2———1+2	56
S4487	♂	17—17—17—15	150	42+	7—7	9—9	1—1	3—3	1—1	1+2———1+2	56
S4488	♂	17—19—17—15	156	81c	8—8	9—9	1—1	2—3	1—1	1+2———1+2	56
S4490	♂	17—19—17—15	149	70c	7—7	8—8	2—2	2—3	1—1	1+2———1+2	56
S4491	♂	17—19—17—15	154	76c	7—7	8—8	2—1	3—3	1—1	1+2———1+2	56

Very interesting from the standpoint of scale variation are the following counts showing, in each group,—first, the counts for the adult female and then those for the well-developed embryos taken from her. In the case of No. S4427 the series is not complete, for only six of the twenty-one embryos of this brood could be counted.

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Local-ity
S4509	♀	19—19—17—15	153	58c	7—7	8—8	1—1	3—3	1—1	1+2—1+2	25
S4509 (1)	..	17—17—15	159	69c	7—7	8—8	2—2	3—3	1—1	1+2—1+2	25
S4509 (2)	..	17—19—17	150	55c	7—7	8—8	2—1	3—3	1—1	1+2—1+2	25
S4509 (3)	..	19—19—17	155	68c	7—7	8—9	2—2	3—3	1—1	1+2—1+2	25
S4509 (4)	..	19—19—17	151	62c	7—7	9—9	1—1	3—3	1—1	1+2—1+2	25
S4509 (5)	..	19—19—17	150	63c	7—7	8—8	2—2	3—3	1—1	1+2—1+2	25
S4509 (6)	..	19—19—17	157	69c	7—7	8—8	1—1	3—3	1—1	1+2—1+2	25
S4509 (7)	..	19—19—17	154	66c	7—7	9—9	1—2	3—3	1—1	1+2—1+2	25
S4509 (8)	..	19—19—17	154	68c	7—7	8—9	1—1	3—3	1—1	1+2—1+2	25
S4517	♀	17—19—17—15	154	60c	7—6	9—10	1—1	3—3	1—1	1+2—1+2	26
S4517 (1)	..	17—17—15	151	62c	7—7	8—8	1—1	3—3	1—1	1+2—1+2	26
S4517 (2)	♂	17—17—15	151	70c	7—7	9—8	1—1	3—3	1—1	1+2—1+2	26
S4517 (3)	..	17—17—15	150	68c	7—7	7—7	1—1	3—3	1—1	1+2—1+2	26
S4517 (4)	♂	17—17—15	150	71c	7—7	8—8	1—1	3—3	1—1	1+2—1+2	26
S4517 (5)	♂	17—17—15	153	66c	7—7	8—9	1—1	3—3	1—1	1+2—1+2	26
S4517 (6)	♂	17—17—15	146	71c	7—7	8—9	1—1	3—3	1—1	1+2—1+2	26
S4517 (7)	♂	17—17—15	148	75c	7—7	8—8	1—1	3—3	1—1	1+2—1+2	26
S4517 (8)	..	17—17—15	147	61c	8—7	8—8	1—1	3—3	1—1	1+2—1+2	26
S4517 (9)	..	17—17—15	150	59c	7—7	8—7	1—1	3—3	1—1	1+2—1+2	26
S4517 (10)	..	17—17—15	149	62c	7—7	7—8	1—1	3—3	1—1	1+2—1+2	26
S4517 (11)	..	17—17—15	149	63c	7—7	7—7	1—1	3—3	1—1	1+2—1+2	26
S4517 (12)	♂	17—17—15	149	64c	7—7	8—9	1—1	3—3	1—1	1+2—1+2	26
S4526	♀	17—19—17—15	150	63c	7—7	8—8	2—1	3—3	1—1	1+2—1+2	26
S4526 (1)	..	17—17—15	148	60c	7—7	8—8	1—1	3—3	1—1	1+2—1+2	26
S4526 (2)	..	17—17—15	156	76c	7—7	8—8	1—1	3—3	1—1	1+2—1+2	26
S4526 (3)	..	17—19—17—15	151	74c	7—7	8—8	1—1	3—3	1—1	1+2—1+2	26
S4526 (4)	..	19—19—17—15	145	64c	8—7	8—8	1—1	3—3	1—1	1+2—1+2	26
S4526 (5)	..	17—17—15	145	58c	7—7	8—8	1—1	3—3	1—1	1+2—1+2	26
S4526 (6)	..	19—19—17—15	148	56c	7—7	8—8	1—1	3—3	1—1	—1+2	26
S4526 (7)	..	17—17—15	154	73c	7—7	8—8	1—1	3—3	1—1	1+2—1+2	26
S4526 (8)	..	17—17—15	149	76c	7—7	8—8	1—1	3—3	1—1	1+2—1+2	26
S4527	♀	17—19—17—15	152	61c	7—7	8—8	1—1	3—3	1—1	1+2—1+2	26
S4527 (1)	..	17—19—17—15	154	59c	7—7	9—9	1—1	3—3	1—1	1+2—1+2	26
S4527 (2)	..	17—19—17—15	149	60c	8—7	9—9	1—1	2—3	1—1	1+2—1+2	26
S4527 (3)	♂	17—19—17—15	150	67c	8—7	9—8	1—1	3—3	1—1	1+2—1+2	26
S4527 (4)	..	17—19—17—15	156	57c	7—7	9—9	1—1	3—3	1—1	1+2—1+2	26
S4527 (5)	..	17—19—17—15	151	58c	7—7	8—8	1—1	3—3	1—1	1+2—1+3	26
S4527 (6)	..	17—19—17—15	154	64c	7—7	8—9	1—1	2—3	1—1	1+2—1+2	26
S4527 (7)	♂	17—19—17—15	149	67c	7—7	9—8	1—2	3—3	1—1	1+2—1+2	26
S4527 (8)	..	17—19—17—15	151	60c	7—7	9—9	1—1	3—3	1—1	1+2—1+1	26
S4527 (9)	..	17—19—17—15	152	57c	7—7	8—8	1—1	2—3	1—1	1+2—1+2	26
S4527 (10)	♂	17—19—17—15	155	61c	7—7	8—9	1—1	3—3	1—1	1+2—1+2	26
S4527 (11)	♂	17—17—15—15	148	42c	7—7	9—8	2—1	2—3	1—1	1+1—1+1	26
S4527 (12)	..	19—19—17—15	149	59c	7—7	9—8	1—1	3—3	1—1	1+2—1+2	26
S4427	♀	19—19—17—15	151	41+	7—7	8—8	1—1	3—3	1—1	1+2—1+2	28
S4427 (1)	..	19—19—17	153	65c	7—7	8—8	1—1	3—3	1—1	1+2—1+2	28
S4427 (4)	..	17—19—17	158	70c	7—7	8—8	1—1	3—3	1—1	1+2—1+2	28
S4427 (6)	..	19—19—17—15	154	56c	7—7	9—9	1—1	3—3	1—1	1+3—1+3	28
S4427 (7)	..	19—19—17	157	59c	7—7	8—8	1—1	3—3	1—1	1+2—1+2	28
S4427 (18)	..	17—19—17	153	....	7—7	8—8	1—1	3—3	1—1	1+2—1+2	28
S4427 (19)	..	19—19—17	152	58c	7—7	9—9	1—1	3—3	1—1	1+2—1+2	28
S4447	♀	17—19—17—15	147	63c	7—7	8—8	1—1	3—3	1—1	1+2—1+2	33
S4447 (1)	..	17—17—15	144	58c	7—7	8—8	1—1	3—3	1—1	1+2—1+2	33
S4447 (2)	..	17—17—15	140	55c	7—7	9—8	2—2	3—3	1—1	1+2—1+2	33
S4447 (3)	..	17—17—15	144	65c	7—7	8—8	1—1	3—3	1—1	1+3—1+2	33
S4447 (4)	..	17—17—15	142	54c	7—7	8—8	1—1	3—3	1—1	1+2—1+2	33
S4447 (5)	♂	17—17—15	142	60c	7—7	8—8	2—2	3—3	1—1	1+2—1+2	33
S4447 (6)	..	17—17—15	141	58c	7—7	8—9	1—2	3—3	1—1	1+2—1+2	33
S4447 (7)	..	17—17—15	150	67c	7—7	8—8	2—2	3—3	1—1	1+2—1+2	33
S4447 (8)	..	17—17—15	141	63c	7—7	8—8	1—1	2—2	1—1	1+2—1+2	33
S4447 (9)	..	17—17—15	144	59c	7—7	8—8	1—2	3—3	1—1	1+2—1+2	33
S4447 (10)	..	17—17—15	147	55c	7—7	8—8	1—1	3—3	1—1	1+2—1+2	33
S4447 (11)	..	17—17—15	147	61c	7—7	8—8	2—2	3—3	1—1	1+2—1+2	33
S4447 (12)	..	17—17—15	142	57c	7—7	8—8	1—1	3—3	1—1	1+2—1+2	33

Remarks.—This is the common garter-snake of the northwest coast. It is of small size. The largest specimen examined measures 590 *mm.* to base of tail. The head is small, not so distinct from the neck as in other races, and the labials are reduced in number.

The coloration is very variable. The dorsal line frequently is absent or developed only on the neck. The lateral lines also may be absent. Specimens may be heavily spotted or without any marking, either lines or spots. The dorsal line usually is yellow but may be red, and there often is red elsewhere in the coloration, as on the gastrosteges. The lower surfaces often are dark, and the coloration everywhere may be very dusky.

Specimens with heavy spotting and dark pigmentation of the gastrosteges resemble *T. o. vagrans,* but usually may be easily distinguished by their scale characters.

Specimens showing no dorsal line resemble *T. o. couchii,* but here again the scale characters are quite different.

The closest relationship of this subspecies undoubtedly is with *T. o. atratus,* yet there can be no doubt as to the subspecific distinctness of the two forms. The differences in the number of superior and inferior labials, scale-rows and gastrosteges should be sufficient aid toward their correct determination, and the general appearance usually is quite different. Certain specimens, however, are so nearly intermediate in one or more of their characters that students might differ in opinion as to their identity. Such specimens, as set forth under head of *T. o. atratus,* show real geographic intergradation. So far as specimens examined by us show, this intergradation occurs only in Del Norte County, California, where the ranges of the two forms meet and perhaps overlap slightly. Many of the specimens from this county are typical of either one or the other subspecies,—*ordinoides* or *atratus,*—and most of the intergrades seem to be nearer to the latter type than to the former. South of Del Norte County no tendency toward *T. o. ordinoides* has been observed in *T. o. atratus,* unless it be that the rather frequent absence of the dorsal line in specimens from Humboldt and Mendocino counties may be so regarded.

Ruthven considered two preoculars to be a character of much importance in *T. o. ordinoides.* Our figures show that

fourteen per cent only of the specimens have two preoculars on one or both sides of the head. Snakes of the *T. o. vagrans* type occur in portions of the area occupied by *T. o. ordinoides,* and often have two preoculars. There seems to be no good reason for calling them *T. o. ordinoides.* It appears much more logical to consider them *T. o. biscutatus,* as was done in 1897, although specimens to show the continuity of range from the Klamath Lakes to Puget Sound are not at hand.

Thamnophis ordinoides atratus (Kennicott)

Coast Garter-Snake.

Diagnosis.—Normally with eight supralabials and ten infralabials. Scales usually in nineteen, sometimes in twenty-one, rows. Gastrosteges average more numerous than in *T. o. ordinoides,* but fewer than in the other subspecies. Coloration very variable, striped, spotted, or (rarely) unicolor, often with some red. Preocular usually single. Size larger than *T. o. ordinoides.*

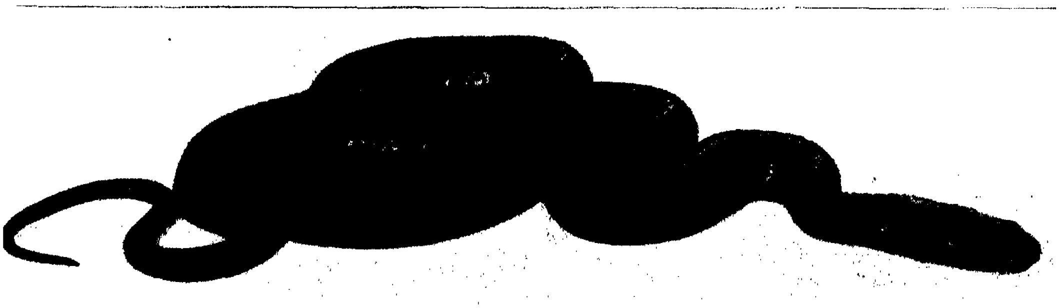
Type Locality.—California. (Brown states that the same specimens served as the types of Cope's *E. i. vidua,* and that they are labeled San Francisco.)

Synonyms.—*Eutænia infernalis* of many authors but not of Blainville. *Eutænia infernalis vidua* Cope, 1892; type locality San Francisco, California.

Range.—This subspecies occupies the coast region of California from Del Norte to Santa Barbara counties. So far as known, the area inhabited by it includes the coast ranges and their valleys but not the great valleys of the Sacramento and San Joaquin. It occurs in both the Transition and Upper Sonoran zones.

We have examined specimens from the following localities:—

1. Near Siskiyou, Jackson Co., Oregon.
2. Gasquet, Del Norte Co., California.
3. Trinidad, Humboldt Co., Cal.
4. Eureka, Humboldt Co., Cal.



Thamnophis ordinoides atratus, Coast Garter-Snake:—Photograph from living specimen collected at Gilroy Hot Springs, Santa Clara Co., California, July 5, 1915.

5. Ferndale, Humboldt Co., Cal.
6. Alton, Humboldt Co., Cal.
7. Carlotta, Humboldt Co., Cal.
8. Cuddeback, Humboldt Co., Cal.
9. Maltole River, White Thorn, Humboldt Co., Cal.
10. South Fork Eel River, Garberville, Humboldt Co., Cal.
11. Anderson, Shasta Co., Cal.
12. Bald Hill, Mendocino Co., Cal.
13. Irishes, Mendocino Co., Cal.
14. Covelo, Mendocino Co., Cal.
15. Ten Mile River, Mendocino Co., Cal.
16. Sherwood, Mendocino Co., Cal.
17. Mendocino, Mendocino Co., Cal.
18. Near Mendocino City, Mendocino Co., Cal.
19. Big River, 7 miles from mouth, Mendocino Co., Cal.
20. Comptche, Mendocino Co., Cal.
21. Albion River, 2 miles below Comptche, Mendocino Co., Cal.
22. Roberts Creek, near Ukiah, Mendocino Co., Cal.
23. Navarro River, near Philo Crossing of Elk on Ukiah Stage Road, Mendocino Co., Cal.
24. Garcia River, ½ to 10 miles above mouth, Mendocino Co., Cal.
25. Point Arena, Mendocino Co., Cal.
26. Pieta, Mendocino Co., Cal.
27. Gualala, Mendocino Co., Cal.
28. Middleton, Lake Co., Cal.
29. Rumsey, Yolo Co., Cal.
30. Wheatfield Fork, Gualala R., Sonoma Co., Cal.
31. Near Skaggs Springs, Sonoma Co., Cal.
32. Skaggs Springs, Sonoma Co., Cal.
33. Cazadero, Sonoma Co., Cal.
34. Duncan Mills, Sonoma Co., Cal.
35. Austins Creek, Sonoma Co., Cal.
36. Kidd Creek, Sonoma Co., Cal.
37. Guerneville, Sonoma Co., Cal.
38. Freestone, Sonoma Co., Cal.
39. Berryessa Creek, Napa Co., Cal.
40. St. Helena, Napa Co., Cal.
41. Vacaville, Solano Co., Cal.

42. Inverness, Marin Co., Cal.
43. Point Reyes, Marin Co., Cal.
44. Tocaloma, Marin Co., Cal.
45. Olema, Marin Co., Cal.
46. Mill Valley, Marin Co., Cal.
47. Walnut Creek, Contra Costa Co., Cal.
48. Berkeley, Alameda Co., Cal.
49. Oakland, Alameda Co., Cal.
50. San Leandro, Alameda Co., Cal.
51. Calaveras Valley, Alameda Co., Cal.
52. San Francisco, San Francisco Co., Cal.
53. San Bruno, San Mateo Co., Cal.
54. Portola, San Mateo Co., Cal.
55. Summit Searsville Road above Woodside, San Mateo Co., Cal.
56. Mountains between Stanford University and Spanishtown, San Mateo Co., Cal.
57. Corte Madera Creek, San Mateo Co., Cal.
58. Butano Basin, San Mateo Co., Cal.
59. La Honda, San Mateo Co., Cal.
60. Pescadero, San Mateo Co., Cal.
61. Near Stanford University, Santa Clara Co., Cal.
62. Corte Madera Canyon, Santa Clara Co., Cal.
63. Stevens Creek, Santa Clara Co., Cal.
64. Santa Clara, Santa Clara Co., Cal.
65. San Jose, Santa Clara Co., Cal.
66. Smith Creek, Mount Hamilton, Santa Clara Co., Cal.
67. Uvas Creek, Santa Clara Co., Cal.
68. Upper Coyote Creek, near head, Santa Clara Co., Cal.
69. Gilroy Hot Springs, Santa Clara Co., Cal.
70. Waddell Creek, Santa Cruz Co., Cal.
71. Near Swanton, Santa Cruz Co., Cal.
72. Felton, Santa Cruz Co., Cal.
73. Soquel, Santa Cruz Co., Cal.
74. Salinas River, near Blanco, Monterey Co., Cal.
75. Seaside, Monterey Co., Cal.
76. Pacific Grove, Monterey Co., Cal.
77. Carmel, Monterey Co., Cal.
78. San Macento, Monterey Co., Cal.
79. Garapatos Creek, Monterey Co., Cal.
80. Mill Creek, Monterey Co., Cal.

81. Little Sur River, Monterey Co., Cal.
82. Partington Canyon, Monterey Co., Cal.
83. Morro, San Luis Obispo Co., Cal.
84. Oceano, San Luis Obispo Co., Cal.
85. Santa Ynez River, Santa Barbara Co., Cal.

Material.—Three hundred and sixty-three specimens from these localities have been studied by us.

Variation.—The variations shown by these specimens are as follows:

The loreal is 1—1 in all specimens. Preoculars are 1—1 in three hundred and thirty-nine, or 93%; 2—2 in fifteen, or 4%; 1—2 in seven, or 1%; and 2—3 in one. Postoculars are 3—3 in three hundred and twenty-one, or 88%; 3—4 in fifteen, or 4%; 2—3 in ten, or 2%; 2—2 in eight, or 2%; 4—4 in six, or 1%; 4—5 in one, and 1—2 in one. Temporals are 1+2—1+2 in two hundred and eighty, or 77%; 1+2—1+3 in forty-four, or 12%; 1+3—1+3 in sixteen, or 4%; 1+1—1+1 in ten, or 2%; 1+1—1+2 in five, or 1%; 1+1—2+2 in two, 1+2—2+2 in two, 1+1—1+3 in one, and 1+3—2+2 in one. The supralabials are 8—8 in three hundred and nine, or 85%; 7—7 in twenty-six, or 7%; 7—8 in twenty-five, or 6%; 8—9 in one, and 9—9 in one. The infralabials are 10—10 in two hundred and seventy-two, or 75%; 9—10 in forty-four, or 12%; 9—9 in thirty-two, or 8%; 10—11 in five, or 1%; 8—9 in three, 8—10 in three, 11—11 in two, and 8—8 in one. The scale-rows are 19—19—17 in two hundred and fifty-five, or 71%; 19—21—17 in twenty-seven, or 7%; 21—21—17 in twenty-two, or 6%; 19—21—19 in twenty-one, or 6%; 21—21—19 in nine, or 2%; 21—19—17 in six, or 1%; 17—19—17 in four, or 1%; 19—19—19 in three, 19—20—19 in three, 20—21—19 in one, 17—18—17 in one, 19—19—15 in one, and 20—21—17 in one. The gastrosteges vary in number from 140 to 172, males having from 146 to 172, females from 140 to 168; the average in one hundred and fifty males is 158, in two hundred and four females, 153. The urosteges vary from 52 to 93, males having from 63 to 93, females from 52 to 98; the average in one hundred and thirty-one males is 81, in one hundred and sixty-eight females, 74. These variations are shown in full in the following table of scale-counts.

Scale counts in *Thamnophis ordinoides atratus*

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Local-ity
S4440	♀	19—21—19—17	159	75c	8—8	10—10	1—1	3—3	1—1	1+2———1+2	1
S4442	♂	19—21—19—17	161	83c	8—8	10—10	1—1	3—3	1—1	1+2———1+2	1
S4266	♀	19—20—19—17	157	74c	8—8	10—10	1—1	3—3	1—1	1+3———1+3	2
29055	♀	19—19—17	149	53+	7—8	9—9	1—1	3—3	1—1	1+2+2—1+2+2	3
29056	♀	17—18—17—15	151	68	8—8	9—9	1—1	3—3	1—1	1+2———1+2+2	3
C2320	♀	21—19—17	150	50+	7—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	4
C2322	♀	19—19—17	153	69	7—7	8—8	1—1	3—3	1—1	1+2+3—2+2+2	4
C2323	♀	19—19—17	153	64	7—8	9—9	1—1	3—3	1—1	———1+2+2	4
C2367	♀	21—21—17	154	70	8—8	10—9	1—1	3—3	1—1	1+2+3—1+3	5
28829	♂	19—19—17	161	84	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	7
28830	♀	19—19—17	153	50+	7—8	10—10	1—1	3—3	1—1	1+3———1+3	7
28831	♀	19—19—17	151	72	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	7
28832	♀	19—21—17	155	67	7—7	10—9	1—1	3—3	1—1	1+2+2—1+2+2	7
28833	♂	19—19—17	156	82	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	7
28834	♀	19—19—17	158	70	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	7
28837	♂	19—19—17	157	85	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	7
28839	♀	19—19—17	155	70	8—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	7
28840	♀	19—19—17	146	69	8—7	9—10	1—1	3—3	1—1	1+2———1+2	7
28841	♀	19—19—17	157	73	7—8	10—10	1—1	3—3	1—1	1+3+3—1+3+3	7
28842	♀	19—19—17	158	80	8—8	9—10	1—1	3—3	1—1	1+3———1+3	7
28843	♂	19—19—17	159	84	7—7	8—9	1—1	3—3	1—1	1+2+2—1+2+2	7
28844	♂	19—19—17	158	83	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	7
28845	♀	19—21—17	153	75	7—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2	7
28846	♀	19—19—17	155	68	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	7
28847	♀	19—19—17	157	74	8—7	10—9	1—1	3—3	1—1	1+2+3—1+2+3	7
28848	♀	19—19—17	152	79	7—7	9—9	1—1	3—3	1—1	1+2———1+2	7
28849	♀	19—19—17	155	80	8—8	9—10	1—1	3—3	1—1	1+2———1+2	7
28850	♀	19—19—17	154	71	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	7
28851	♂	19—19—17	165	85	7—7	10—10	1—1	3—3	1—1	1+2+1—1+2+1	7
28852	♀	19—19—17	156	77	7—7	10—10	1—1	3—3	1—1	1+2———1+2	7
28853	♂	19—19—17	163	84	8—8	10—10	2—2	3—3	1—1	1+2+2—1+2+2	7
28854	♀	19—19—17	160	77	7—7	10—10	1—1	3—3	1—1	1+3———1+2	7
28855	♀	19—19—17	160	71	8—8	10—10	1—1	3—3	1—1	2+2+2—1+1+3	7
28856	♀	19—19—17	158	74	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	7
28857	♀	19—19—17	158	77	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	7
28858	♀	19—19—17	155	78	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+3	7
28859	♀	19—19—17	157	68+	7—7	10—10	1—1	3—3	1—1	1+2———1+2	7
28860	♂	19—19—17	160	84	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	7
28861	♀	19—19—17	156	66+	8—7	10—10	1—1	3—3	1—1	1+2+1—1+2+1	7
28862	♀	19—19—17	154	75	8—8	10—10	1—1	3—3	1—1	1+2———1+2	7
28863	♀	19—19—17	158	77	7—8	9—9	1—1	3—3	1—1	1+2+2—1+2+2	7
28864	♂	19—19—17	156	85	8—7	10—9	1—1	3—3	1—1	1+2+1—1+2+1	7
28865	♀	21—21—17	161	72	8—8	10—10	1—1	3—2	1—1	1+2+2—1+2+2	7
28866	♀	19—19—17	151	74	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	7
28867	♂	19—19—17	166	86	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	7
28868	♀	19—19—17	156	67	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	7
28869	♀	19—19—17	154	26+	8—8	10—10	1—1	3—3	1—1	1+2+1—1+2+1	7
28870	♂	19—19—17	160	84	7—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	7
28871	♂	19—19—17	157	90	8—8	10—9	1—1	3—3	1—1	1+2+1—1+2+1	7
28872	♂	19—19—17	165	81	8—8	10—10	2—2	3—3	1—1	1+2+2—1+2+2	7
28873	♂	19—19—17	155	88	7—7	9—10	1—1	3—3	1—1	1+2+2—1+2+2	7
28874	♀	19—19—17	153	73	8—8	10—10	1—1	3—3	1—1	1+2———1+2	7
28875	♂	19—19—17	156	82	8—8	10—10	1—1	3—3	1—1	1+2+1—1+2+2	7
28876	♀	19—19—17	157	9+	8—8	10—9	1—1	3—3	1—1	1+2———1+2	7
28877	♂	19—21—17	165	87	7—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2	7
28878	♀	19—19—17	157	42+	8—8	10—9	2—1	3—3	1—1	1+2———1+2	7
28879	♀	19— ?—17	154	73	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	7
28880	♂	19—19—17	160	83	7—7	9—10	1—1	3—3	1—1	1+2+2—1+2+2	7
28881	♀	19—19—17	157	72	8—8	9—10	1—1	3—3	1—1	2+2+2—1+2+3	7
28882	♀	19—19—17	157	71	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	7
28883	♀	19—19—17	157	74	7—7	10—10	1—1	3—3	1—1	1+3———1+3	7
28884	♀	19—21—17	156	71	8—8	10—10	1—1	3—3	1—1	1+2———1+2	7
28885	♂	19—19—17	157	80	7—7	9—9	1—1	3—3	1—1	1+2———1+2	7
28886	♀	19—19—17	149	74	8—8	10—9	1—1	3—2	1—1	1+2———1+2	7
28887	♂	19—19—17	158	57+	7—7	10—10	1—1	3—3	1—1	1+2+1—1+2+1	7
28888	♂	19—19—17	159	28+	8—8	10—9	1—1	3—3	1—1	1+2+2—1+2+2	7
28889	♀	19—19—17	157	82	8—8	10—9	1—1	3—3	1—1	1+2———1+2	7
28890	♂	19—19—17	155	83	8—8	9—9	2—1	3—3	1—1	1+2+2—1+2+2	7
28891	♂	19—19—17	158	71+	7—7	10—10	1—1	3—3	1—1	1+2+1—1+2+1	7
28892	♀	19—19—17	155	73	8—7	10—10	1—1	3—3	1—1	1+2+2—1+2+2	7
28893	♀	19—19—17	156	75	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	7
28976	♂	19—19—17	159	82	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	6
28977	♀	19—19—17	160	73	8—8	10—10	1—1	3—3	1—1	1+2———1+2	6
28978	♂	19—19—17	155	84	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	6
28979	♂	19—19—17	162	84	8—8	10—10	1—1	3—3	1—1	1+2———1+2	6

Scale counts in *Thamnophis ordinoides atratus*—Continued

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Local-ity
C2366	♀	19—19—17	161	77	8—8	9—9	1—1	3—3	1—1	1+2+2—1+2+2	8
C2368	♂	19—19—17	154	79	8—8	9—10	1—1	3—3	1—1	1+2+2—1+2+2	8
S4228	♀	19—19—17—15	153	75c	8—8	10—10	1—1	3—3	1—1	1+3——1+2	9
S4221	♂	19—19—17—15	155	77c	7—8	10—10	1—1	3—3	1—1	1+2——1+2	10
S4242	♂	19—19—17—17	159	79c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	10
S4243	♀	19—19—17—15	150	74c	8—8	10—10	1—1	4—4	1—1	1+2——1+2	10
S4313	♂	20—21—19—17	170	91c	8—8	10—10	1—1	4—3	1—1	1+2——1+2	11
S4434	♀	21—19—17—17	166	38+	8—8	10—10	1—1	3—3	1—1	2——2	11
C1165	♂	19—19—17	161	65	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	12
C1166	♂	19—19—17	157	75	8—8	9—9	1—1	3—3	1—1	1+2+3—1+2+3	12
S1795	♂	19—19—17—15	158	85c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	13
C5323	♂	19—19—17	163	83	8—8	10—10	1—1	3—3	1—1	1+2+3—1+3+3	14
S4240	♀	19—19—17—17	145	71c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	15
C1163	♂	19—19—17	158	82	8—8	10—10	1—1	4—3	1—1	1+2+1—1+2+2	16
C1167	♂	19—19—17	161	82	8—8	10—10	1—1	3—3	1—1	1+2——1+2	16
C1168	♀	19—19—17	154	73	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	16
S1760	♀	19—19—17—17	149	79c	8—8	10—8	1—1	3—3	1—1	1+2——1+2	16
28620	♂	19—19—17	152	6+	7—7	8—9	1—1	3—3	1—1	1+2+2—1+2+2	17
C5315	♂	19—21—17	153	54+	7—8	10—10	1—1	3—3	1—1	1+2——1+2	17
C5317	♀	19—19—17	151	75	8—8	9—10	1—1	3—3	1—1	1+2+2—1+3+3	17
S4247	♂	19—21—19—17	155	80c	8—8	10—10	1—1	3—3	1—1	1+2——1+3	18
S4248	♂	19—19—17—15	161	82c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	18
S4249	♀	19—19—17—15	144	71c	8—8	10—8	1—1	3—3	1—1	1+2——1+2	19
28302	♂	19—19—17	155	75	8—8	10—10	1—1	3—3	1—1	1+3——1+2	20
28303	♂	19—19—17	158	85	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	20
28304	♂	19—19—17	155	78	8—7	9—9	1—1	3—3	1—1	1+2——1+2	20
28305	♀	19—19—17	149	76	8—8	9—10	1—1	3—3	1—1	1+2——1+2	20
28306	♂	19—19—17	160	89	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	20
28307	♀	21—21—17	151	71+	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	20
28308	♂	19—19—17	152	83	8—8	9—9	1—1	3—3	1—1	1+2+1—1+2+2	20
S4237	♂	19—19—17—17	150	79c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	21
S4238	♂	19—19—17—17	150	80c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	21
S4233	♂	19—19—17—17	161	85c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	22
S4234	♀	19—19—17—17	147	81c	9—9	10—10	1—1	3—3	1—1	1+2——1+3	22
S4241	♀	19—19—17—17	145	74c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	23
S4250	♂	19—19—17—17	153	78c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	23
S4251	♀	19—19—17—17	143	73c	8—8	10—10	1—1	3—3	1—1	1+3——1+3	23
S4252	♀	19—19—17—17	144	77c	8—8	10—10	1—1	3—3	1—1	1+3——1+1	23
S4236	♀	19—19—17—17	148	73c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	24
S4244	♀	19—19—17—15	150	79c	8—8	10—10	1—1	3—3	1—1	1+3——1+3	24
S4245	♀	19—19—17—15	147	73c	8—8	10—10	1—1	2—3	1—1	1+2——1+2	24
S4253	♀	19—19—17—17	147	72c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	24
C5313	♀	19—19—17	144	71	7—7	9—8	1—1	3—3	1—1	1+3——1+3	25
C5314	♀	19—19—17	150	62	8—8	9—10	1—1	3—3	1—1	1+2+2—1+2+2	25
S6440	♂	19—19—17—17	163	85c	7—7	9—9	1—1	3—3	1—1	1+2——1+2	26
S4130	♀	19—19—17—17	155	78c	8—8	10—10	1—1	3—3	1—1	1+3——1+2	26
C5301	♀	19—19—17	152	73	8—8	10—10	1—1	3—3	1—1	1+1——1+1	27
C5302	♀	19—19—17	151	77	8—8	10—10	1—1	3—3	1—1	1+2——1+2+2	27
C5303	♀	19—19—17	155	38+	8—8	9—9	1—1	3—3	1—1	1+2+2—1+2+2	27
C5304	♀	19—19—17	154	73	8—8	—10	1—1	3—3	1—1	1+2+2—1+2+2	27
C5305	♀	19—19—17	156	29+	8—8	10—9	1—1	3—3	1—1	1+2+3—1+2+3	27
C5306	♀	19—19—17	148	71	8—8	10—10	2—2	3—3	1—1	1+3+3—1+2+2	27
C5307	♂	19—19—17	153	78	8—8	10—10	1—1	3—3	1—1	1+3——1+3	27
C5308	♀	19—19—17	150	61	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	+27
C5309	♂	19—19—17	161	77	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	27
C5310	♀	19—19—17	156	73	8—8	10—10	1—1	4—4	1—1	1+2+3—1+2+3	27
C5311	♀	19—19—17	152	64	8—8	10—10	1—1	3—3	1—1	1+3——1+2	27
C5312	♂	19—19—17	154	85	7—7	10—10	1—1	3—3	1—1	1+2+2—1+3+2	27
C5336	♀	19—19—17	149	71	8—8	10—10	1—1	3—3	1—1	1+2——1+2	27
C5337	♂	19—19—17	151	83	8—8	9—10	1—1	3—3	1—1	1+2+2—1+2+2	27
C5338	♀	19—19—17	140	65	8—8	10—10	1—1	3—3	1—1	1+2——1+2	27
S4131	♂	19—19—17—17	166	84c	8—8	10—10	1—1	3—3	1—1	1+2——1+3	28
C4005	♀	19—19—17	162	75	8—8	10—10	1—1	3—3	1—1	1+3——1+3	29
S4219	♀ ?	19—19—17—17	152	9+	8—8	9—9	1—1	3—3	1—1	1+3——1+2	30
S4229	♂	19—19—17—15	164	82c	8—8	10—10	1—1	3—3	1—1	1+3——1+2	30
S4230	♂	19—19—17—17	159	90c	7—8	10—10	1—1	3—3	1—1	1+2——1+2	30
S4231	♀	19—19—17—17	152	73c	8—8	10—10	1—1	3—3	1—1	1+3——1+2	30
S4256	♀	19—19—19—17	150	76c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	31
S4257	♀	19—19—17—15	154	72c	8—8	10—11	1—1	3—3	1—1	1+2——1+2	31
S4258	♀	19—19—17—17	143	72c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	32
28019	♀	19—19—17	152	73	8—8	10—10	1—1	2—2	1—1	1+1——1+1	32
28020	♀	19—19—17	155	78	8—8	9—9	1—1	3—3	1—1	1+2——1+2	32
28021	♂	19—19—17	159	93	8—8	10—10	1—1	3—3	1—1	1+3——1+2+2	32
28024	♀	19—19—17	152	72+	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2	32
28025	♂	19—19—15	161	87	8—8	10—10	1—1	?—?	1—1	1+1——1+2	32

Scale counts in *Thamnophis ordinoides atratus*—Continued

Number	Sex	Scale rows	Gastrosteges	Urostegen	Supralabials	Infralabials	Preoculars	Postoculars	Loreals	Temporals	Locality
28029	♂	19—19—17	164	88	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	32
C5298	♀	21—21—17	158	54+	8—8	10—10	1—1	3—4	1—1	1+2+2—1+2+2	33
C5299	♀	19—19—17	155	78	8—8	10—10	1—1	4—4	1—1	1+2——1+2	33
C5300	♀	19—21—17	149	68	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	33
27938	♂	19—19—17	162	84+	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	34
27939	♀	19—19—17	150	24+	?—8	9—10	1—1	?—3	1—1	1+2——1+2	34
27940	♂	19—19—17	159	82	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	34
27941	♂	19—19—17	159	49+	8—8	10—10	1—1	3—3	1—1	1+3+3—1+2+3	34
28010	♀	19—19—17	145	25+	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	35
27982	♂	19—19—17	159	82	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	36
C4913	♀	19—19—17	150	75	8—8	10—10	2—2	3—3	1—1	1+2+2—1+2	37
C4914	♂	19—19—17	154	83	8—8	10—9	1—1	2—2	1—1	1+3——2+2	37
S4323	♂	19—19—17—17	158	87c	7—8	9—9	1—1	3—3	1—1	1+3——1+2	37
C5295	♂	19—19—17	165	71	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	38
C5296	♂	19—19—17	161	77	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	38
C5297	♂	19—19—17	165	79	8—8	9—10	1—1	4—4	1—1	1+2+2—1+2+2	38
S6310	♂	19—19—17—17	157	88c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	39
S6311	♀	19—19—17—17	154	76c	8—8	9—10	1—1	3—3	1—1	1+3——1+3	39
S6312	♀	19—19—19—17	152	74c	8—8	10—10	1—1	3—3	1—1	1+3——1+2	39
S6313	♂	19—19—17—17	164	82c	8—8	10—9	1—1	3—3	1—1	1+2——1+2	39
S6314	♂	19—19—17—17	156	80+	8—8	10—10	1—1	4—3	1—1	1+1——1+1	39
13178	♂	19—21—17	160	84	8—8	10—10	1—1	3—3	1—1	1+2——1+2	40
C4006	♀	19—19—17	154	27+	8—8	10—10	1—1	3—4	1—1	1+2——1+2	41
C4007	♀	19—19—17	154	79	8—8	10—9	1—1	3—3	1—1	1+3——1+2	41
C4008	♂	19—19—17	160	81	8—8	10—10	1—1	3—3	1—1	1+2——1+2	41
C5290	♂	19—19—17	159	60+	8—8	9—9	1—1	3—2	1—1	1+2+3—1+2+3	42
C5292	♂	19—19—17	165	64	8—8	10—9	1—1	3—3	1—1	1+2+3—1+2+3	42
C5293	♀	19—19—17	153	69	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	42
C5287	♂	19—19—17	157	81	8—8	10—10	2—2	3—3	1—1	1+2+2—1+2+2	43
C5288	♂	19—19—17	155	79	8—8	9—9	1—1	3—3	1—1	1+2+3—1+2+3	43
C5291	♀	21—21—17	153	71	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	43
27814	♀	19—19—17	151	74	8—8	10—10	1—1	4—3	1—1	1+2+2—1+2+2	44
27816	♂	19—19—17	136	85	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	44
27817	♂	19—19—17	158	89	8—8	10—10	1—1	3—3	1—1	1+2——1+2	44
27818	♀	19—21—17	159	65+	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	44
27819	♀	19—21—17	156	74	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	44
S5181	♂	19—19—17—17	160	78c	8—7	10—10	1—1	3—3	1—1	1+2——1+2	45
C2438	♂	19—19—17	167	48+	8—8	10—10	1—1	3—3	1—1	1+2+1—1+2+2	46
C4009	♀	19—19—17	148	80	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	47
C843	♂	19—19—17	164	85	8—8	10—10	2—2	3—3	1—1	1+2+2—1+2+2	48
C844	♀	19—19—17	164	72	8—8	9—9	1—1	3—3	1—1	1+2+2—1+3	48
C845	♂	19—19—17	171	88	8—8	10—10	1—1	3—2	1—1	1+2+2—1+2+2	48
C846	♀	21—21—17	161	72	8—8	10—10	2—2	3—3	1—1	1+2+3—1+3+2	48
C1627	♀	19—21—17	160	76	8—8	11—11	1—1	3—3	1—1	1+2+2—1+2+2	48
C1628	♀	19—19—17	165	73	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2	48
C1629	♀	19—19—17	152	80	8—8	10—11	1—1	3—3	1—1	1+3——1+2	48
C1630	♂	19—19—17	172	89	8—8	10—10	1—1	3—3	1—1	1+2+1—1+2+1	48
C1634	♀	21—21—17	156	79	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	48
C2439	♀	19—21—17	164	74	8—8	10—10	2—3	3—3	1—1	1+2+2—1+2+2	48
C2440	♂	19—17	170	90	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	48
C2441	♀	19—21—17	161	70	8—8	9—10	1—1	3—3	1—1	1+2——1+3	48
C2442	♂	19—19—17	168	86	8—7	9—10	1—1	3—3	1—1	1+2+2—1+2+3	48
C2443	♂	19—21—17	164	80	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	48
C2444	♀	21—21—17	156	78	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	48
C2445	♀	19—21—17	161	54+	8—8	10—10	1—1	3—3	1—1	1+2+2—1+1+1	48
C2446	♀	21—21—17	163	77	8—8	10—10	1—1	2—2	1—1	1+3——1+3	48
C2448	♂	19—19—17	169	72	8—8	10—10	1—1	3—3	1—1	1+2+1—1+2+1	48
C2449	♂	19—19—17	166	86	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+2	48
C2450	♀	21—21—17	155	73	8—8	10—10	2—2	3—3	1—1	1+2+2—1+2+2	48
C2451	♀	21—21—17	163	73	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	48
C2452	♂	19—21—17	167	73	8—8	10—10	1—2	3—3	1—1	1+2+2—1+2+2	48
C2453	♀	19—21—19—17	160	77	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	48
C2454	♀	21—21—17	161	73	8—8	10—10	1—1	3—3	1—1	1+2——1+2	48
C2455	♂	19—19—17	164	85	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	48
C2456	♂	19—21—17	170	87	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	48
C2457	♂	19—19—17	159	81	8—8	10—10	1—1	3—4	1—1	1+2+2—1+2+2	48
C2458	♀	19—19—17	165	78	8—8	10—10	2—2	3—3	1—1	1+2+2—1+2+2	48
C2459	♀	19—19—17	168	50+	8—8	10—10	1—1	2—2	1—1	1+3——1+3	48
C2461	♂	19—21—17	163	81	8—8	10—10	1—1	3—3	1—1	1+3+3—1+2+3	48
C2462	♂	—19—17	152	74	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	48
C3757	♀	19—19—17	148	78	8—8	10—10	1—1	3—3	1—1	1+3——1+2	48
C4314	♀	21—21—17	158	52	8—7	9—9	1—1	3—4	1—1	1+2+2—1+2+2	48
C5417	♀	19—21—17	159	80	8—8	10—10	2—2	3—3	1—1	1+2+2—1+2+2	48
C5418	♂	19—21—17	164	81	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	48
C5419	♀	19—19—17	159	78	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	48

Scale counts in *Thamnophis ordinoides atratus*—Continued

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Local-ity
C5555	♀	21—21—19—17	159	77c	8—8	11—10	2—1	3—3	1—1	1+3——1+3	48
C2437	♂	21—21—17	167	78	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	49
C2460	♂	19—21—17	164	87	8—8	10—10	1—1	3—4	1—1	1+3——1+2	49
13223	♂	21—21—17	165	79	8—8	9—9	1—1	2—2	1—1	1+2+2—1+2+2	50
C2436	♂	19—19—17	153	81	8—8	9—9	1—1	3—3	1—1	1+3——1+2+2	50
S4161	♀	19—19—17—15	148	74c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	51
39565	♀	19—21—19—17	157	73	8—8	10—10	2—1	3—3	1—1	1+2+3—1+2+3	52
39566	♀	19—21—19—17	153	72	8—8	10—10	1—1	3—4	1—1	1+2——1+2	52
27286	♂	19—19—17	157	82	8—8	10—8	1—1	3—3	1—1	1+2+2—1+2+2	52
33350	♀	21—21—17	154	67	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	52
33351	♂	21—19—17	153	80	8—8	9—9	1—1	3—3	1—1	1+1+2—1+2+2	52
33352	♀	19—19—17	157	75	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	52
33353	♀	19—19—17	159	78	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	52
33354	♂	21—21—17	158	76	8—8	10—10	1—1	3—3	1—1	1+1+2—1+2+2	52
33355	♀	21—21—17	155	69	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	52
33356	♂	19—19—17	162	82	8—8	9—10	1—1	3—3	1—1	1+2+2—1+2+2	52
38943	♀	21—21—17	152	53+	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	52
39200	♀	19—21—17	155	50+	8—8	9—10	1—1	3—3	1—1	1+2+3—1+2+3	52
39557	♀	19—21—19—17	153	74	8—8	10—10	1—1	3—3	1—1	1+2——1+2	52
39558	♂	19—21—19—17	157	63	8—8	10—10	1—1	3—3	1—1	1+2——1+2	52
39559	♀	19—21—17—15	148	66	8—8	10—10	1—1	3—3	1—1	1+2——1+2	52
39560	♂	19—21—17	154	78	8—8	9—9	1—1	3—3	1—1	1+2——1+2	52
13225	♀	21—19—17	159	76	8—8	10—10	1—1	3—3	1—1	1+2——1+2	52
13226	..	19—21—19—17	157	73	8—8	10—10	2—2	3—3	1—1	1+2——1+2	52
13227	..	19—19—17	157	68	7—8	9—9	1—1	3—3	1—1	1+2——1+2	52
13228	..	19—19—17	157	77	8—8	10—10	1—1	3—3	1—1	1+2——1+2	52
13229	..	19—19—17	157	70	8—8	10—10	2—1	3—3	1—1	1+2——1+2	52
13231	..	19—19—17	157	66	8—8	9—10	1—1	3—3	1—1	1+2——1+2	52
13235	?	19—19—17	157	70	8—8	9—9	1—1	3—3	1—1	1+2——1+2	52
13239	♂	19—19—17	161	61+	8—8	10—10	1—1	3—3	1—1	1+2——1+2	52
13247	♀	19—19—17	154	68	8—8	9—10	1—1	4—3	1—1	1+2——1+2	52
14498	♀	19—19—17	160	74	8—8	10—10	1—1	3—3	1—1	1+2——1+2	52
14499	♂	19—19—17	163	83	8—8	10—10	1—1	3—3	1—1	1+2——1+2	52
14500	♂	19—21—17	158	78	8—8	10—10	1—1	3—3	1—1	1+2——1+2	52
S.R.22	♂	19—19—17—17	164	93c	7—7	10—10	1—1	3—3	1—1	1+2——1+2	53
S.R.21	♀	19—19—17—17	150	70	8—8	10—10	1—1	3—3	1—1	1+2——1+1	54
S1123	♂	19—19—17—17	149	79c	8—8	10—9	1—1	3—3	1—1	1+2——1+2	55
S1654	♀	19—19—17—17	146	69	8—8	10—10	1—1	3—3	1—1	1+2——1+3	55
S1655	♀	19—19—17—15	144	71c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	55
S4322	♂	19—19—17—15	146	77c	8—8	9—9	1—1	3—2	1—1	1+3——1+2	56
S5180	♀	19—19—17—15	151	73c	8—8	10—10	1—1	3—3	1—1	1+3——1+2	57
S5184	♀	19—19—17—15	143	66c	8—8	10—10	1—1	3—3	1—1	1+1——1+1	58
S.R.68	♀	19—19—17—17	150	74c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	59
S1198	♀	19—19—17—15	143	59+	8—8	10—10	1—1	3—3	1—1	1+2——1+2	59
S4149	♂	19—19—19—17	153	85c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	59
S4155	♂	17—19—17—15	155	86c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	59
S1136	♀	19—21—19—17	152	68c	8—8	10—10	1—1	3—3	1—1	1+3——1+2	60
S1137	♂	19—19—17—17	161	67c	8—8	10—10	1—1	3—2	1—1	1+2——1+2	60
S1139	♀	19—21—19—17	158	73+	8—8	10—10	1—1	4—4	1—1	1+2——1+2	60
S1200	♀	19—19—17—15	145	21+	8—8	10—10	1—1	3—3	1—1	1+3——1+2	60
S1201	♀	19—19—17—17	148	71c	8—8	10—10	2—2	3—3	1—1	1+2——1+2	60
S1202	♀	19—19—17—15	146	38+	8—8	10—10	1—1	3—3	1—1	1+2——1+2	60
S1203	♂	19—19—17—15	153	83c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	60
S1204	♀	17—19—17—15	146	70+	8—8	10—10	1—1	3—3	1—1	1+3——1+2	60
S1205	♀	19—19—17—15	149	65c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	60
S1209	♂	21—21—19—17	167	75+	8—8	9—10	1—1	3—3	1—1	1+2——1+3	60
S1671	♂	19—21—17—17	163	80c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	60
S1672	♂	19—19—17—17	158	84c	8—8	10—10	1—1	3—3	1—1	1+3——1+2	60
S4154	♂	21—21—17—17	162	80c	8—7	9—10	1—1	3—3	1—1	1+2——1+3	60
S5182	♀	21—21—19—17	152	71+	8—8	9—10	1—1	3—3	1—1	1+2——1+2	60
S5183	♂	19—19—17—17	154	82c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	60
S5185	♀	19—21—17—17	151	74c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	60
S.R. 7	♂	19—19—17—15	153	43+	8—8	10—10	1—1	3—3	1—1	1+2——1+2	61
S.R.53	♀	19—21—17—17	163	73c	8—8	10—10	1—1	2—2	1—1	1+1——2+2	61
S4101	?	19—19—17—15	165	3+	8—8	10—10	1—1	4—3	1—1	1+2——1+2	61
S4157	♀	19—19—17—15	147	71+	8—8	10—10	1—1	3—3	1—1	1+2——1+2	61
S4225	♀	19—21—19—17	162	71c	8—8	10—10	1—1	3—3	1—1	1+1——1+1	61
S6378	♀	19—19—17—15	153	73c	8—7	10—10	1—1	2—3	1—1	1+2——1+2	61
S6380	♂	17—19—17—15	155	75c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	61
S.R.69	♂	19—19—17—17	157	85c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	62
S.R.64	♂	19—19—17—15	155	80c	9—8	10—11	1—1	3—3	1—1	1+2——1+2	63
S.R.65	♀	19—19—17—15	147	74c	8—7	10—10	1—1	4—3	1—1	1+2——1+2	63
S.R.66	♂	21—21—19—17	161	85c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	63
S.R.67	♂	19—19—17—15	154	82c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	63
S4135	♂	19—19—17—17	156	80c	8—8	10—10	1—1	4—3	1—1	1+2——1+2	63

Scale counts in *Thamnophis ordinoides atratus*—Continued

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Local-ity
S1743	♀	19—19—17—17	152	75c	8—8	9—9	1—1	3—3	1—1	1+2——1+3	64
S1744	♀	19—21—19—17	162	77c	8—8	10—10	1—1	3—4	1—1	1+2——1+2	64
S1745	♀	19—19—17—17	154	78c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	64
41661	♂	19—19—17—15	164	79c	8—8	10—10	2—2	3—3	1—1	1+2——1+2	65
41662	♂	19—19—17—17	163	58+	8—8	10—10	2—1	3—3	1—1	1+2——1+2	65
41663	♂	19—21—19—17	159	87c	8—8	10—10	1—1	2—3	1—1	1+2——1+3	65
S4091	♀	19—19—17—17	156	75c	8—8	10—10	2—2	4—3	1—1	1+2——1+2	66
S6520	♂	19—19—17—15	153	23+	8—8	10—10	1—1	3—3	1—1	1+2——1+2	67
S5852	♂	19—19—17—15	161	79+	8—8	10—10	1—1	3—3	1—1	1+2——1+2	68
39653	♀	19—19—17—17	159	74c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	69
39652	♀	19—19—17—17	156	36+	8—8	10—9	1—1	3—3	1—1	1+2——1+2	69
S1675	♀	19—19—17—15	150	71c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	70
S4150	♂	17—19—17—15	151	79c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	70
S4151	♀	19—19—17—17	142	75c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	70
S4152	♀	19—19—17—15	147	74c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	70
S4153	♀	19—19—17—15	143	66c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	70
S.R.71	♀	19—19—17—15	148	72c	8—8	10—9	1—1	3—3	1—1	1+2——1+2	71
S4186	♀	21—21—19—17	153	68c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	72
S1652	♀	19—21—19—17	157	73c	8—7	10—10	1—1	3—3	1—1	1+2——1+2	73
S1674	♀	21—21—19—17	158	73c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	73
S1679	♀	19—19—17—17	149	72c	8—8	10—10	1—1	4—4	1—1	1+2——1+2	73
S1774	♀	19—21—19—17	156	86c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	73
S4144	♂	19—19—17—17	158	84c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	73
S4148	♀	19—19—17—17	147	73c	8—8	11—10	1—1	3—3	1—1	1+2——1+3	73
S4319	♀	21—21—19—17	153	72c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	73
S4275	♀	19—21—19—17	156	67c	8—8	10—10	1—1	3—2	1—1	1+3——1+3	74
13764	♂	19—19—17	149	76	8—8	9—10	1—1	3—3	1—1	1+2——1+2	75
13765	♂	19—19—17	157	59+	8—8	10—10	1—1	3—3	1—1	1+2——1+2	75
S.R.61	♂	19—21—19—17	154	67+	8—8	9—9	1—1	3—3	1—1	1+2——1+2	76
S.R.62	♀	21—21—19—17	154	66+	8—8	9—9	1—1	1—2	1—1	1+2——1+2	76
S1682	♂	19—20—19—17	158	81c	8—8	10—10	1—1	2—2	1—1	1+2——1+2	76
S1685	♀	19—19—17—17	146	64c	8—8	10—10	1—1	2—2	1—1	1+1——1+1	76
S1696	♂	21—21—17—17	156	44+	8—8	10—9	1—1	3—3	1—1	1+2——1+3	76
S5143	♀	19—19—17—15	143	67+	8—8	10—10	1—1	3—3	1—1	1+1——1+1	76
S5144	♀	19—19—17—17	153	62c	8—8	10—10	2—1	5—4	1—1	1+2——1+2	76
S5145	♀	19—21—19—17	155	67c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	76
S5146	♀	19—19—17—17	155	69c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	76
S5147	♀	19—19—17—17	140	69+	8—8	10—10	1—1	3—3	1—1	1+2——1+2	76
S5148	♂	19—19—17—17	159	79c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	76
S5149	♀	19—19—17—17	147	66c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	76
S5150	♂	21—21—19—17	154	58+	8—8	10—10	1—1	3—3	1—1	1+3——1+3	76
13756	♂	19—20—19—17	160	67	8—8	10—9	1—1	3—3	1—1	1+2——1+2	77
13757	♀	19———19—17	145	66	7—7	10—10	1—1	3—3	1—1	1+1——1+1	77
13758	♀	20—21—17	157	69	8—8	10—10	1—1	3—3	1—1	1+2——1+2	77
13759	♀	19—19—17	149	71	8—8	10—10	1—1	3—3	1—1	1+2——1+2	77
13760	♂	19—19—17	154	79	8—8	10—10	1—1	3—3	1—1	1+2——1+2	77
13761	♂	19—19—17	153	47+	8—8	10—10	1—1	3—3	1—1	1+2——1+2	77
S4306	♀	19—19—17—15	150	73c	8—8	11—11	1—1	3—3	1—1	1+2——1+2	78
S4307	♂	19—19—17—17	152	75c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	78
S4308	♀	19—19—17—15	150	73c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	78
S4309	♀	19—19—17—15	151	71c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	78
S4310	♀	19—19—17—15	144	67c	8—8	10—10	1—1	3—3	1—1	1+1——1+1	78
S4311	♀	19—19—17—17	151	77c	8—8	10—10	1—1	3—3	1—1	1+1——1+1	78
S5189	♂	21—21—17—17	159	74c	8—8	10—10	1—1	3—3	1—1	1+3——1+2	79
S5193	♀	19—21—19—17	159	74c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	80
S5194	♀	21—19—17—17	156	21+	8—8	10—10	1—1	3—3	1—1	1+2——1+2	80
S5191	♀	19—19—17—17	154	72c	8—8	10—10	1—1	3—3	1—1	1+3——1+2	81
S5195	♂	19—19—17—17	159	78c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	81
S5190	♀	21—19—17—17	153	40+	8—8	10—10	1—1	3—3	1—1	1+2——1+2	82
43372	♀	19—19—17—17	153	61+	8—8	10—10	1—1	3—3	1—1	1+2——1+2	83
43366	♀	19—21—19—17	155	67c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	84
43367	♂	19—19—17—17	163	81c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	84
C4317	♂	19—21—17	159	82	8—8	10—10	1—1	3—3	1—1	1+2——1+2	85

Remarks.—The large series at hand shows that this subspecies, which one of us formerly confused with *T. o. elegans*, and which Brown and Ruthven confused with *T. o. ordinoides*, really should be separated from both. From *T. o. elegans* it differs in the smaller average number of its scale-rows and ventral plates, as well as in coloration. The dorsal line usually is wider than in *T. o. elegans* and there often is more or less red in the coloration, which so far as we know is not the case in the mountain snakes.

T. o. atratus differs from *T. o. ordinoides* in being of larger size and in usually having a greater number of upper and lower labials, scale-rows, and gastrosteges. The coloration also is different, although a wide range in pattern and shade is to be seen in both subspecies, and both often show some red coloring.

As regards scale characters, *T. o. atratus* may be considered intermediate between *T. o. ordinoides* and *T. o. elegans*.

The two specimens from Siskiyou, Jackson County, Oregon, and two others (Nos. S4313 and S4434) from Anderson, Shasta County, California, probably might best be regarded as showing intergradation between this coast form and the *T. o. elegans* of the Sierra Nevada, since they all have twenty-one rows of scales and somewhat intermediate coloration. The material is inadequate to make this conclusion a positive one but it is in this region that one would expect to find these subspecies merging.

Five specimens (Nos. S4471, S4473, S4474, S4476, and S4479) from South Fork, Coquille River, twenty miles above Myrtle Point, Coos County, Oregon, are listed in this paper as *T. o. biscutatus*. They, however, are not typical of that form in that they have only nineteen rows of scales. They thus resemble *T. o. atratus* in this character and might well be regarded as intergrades. Additional specimens are needed from this general region. The coloration of these specimens is similar to that of *T. o. couchii* in the indistinctness of the dorsal line and presence of dark pigmentation on the gastrosteges. Two specimens from Gasquet, Del Norte County, California, resemble these but are so puzzling that one (No. S4264) has been referred to *T. o. biscutatus* and the other (No. S4266) to *T. o. atratus*. Both have more than nineteen scale-rows, a

fairly large number of gastrosteges, and indistinct dorsal lines. More material is needed to clear up their status.

Certain specimens from Requa and Crescent City in Del Norte County, California, show intergradation between *T. o. atratus* and *T. o. ordinoides*. This is apparent in the reduction in the number of upper and lower labials, and, sometimes, of the gastrosteges. Some of the specimens from these localities are fairly typical *T. o. atratus*, and nearly all are closer to that form than to *T. o. ordinoides*. The scale-counts in these two series of specimens are given below. Nos. 29076 to 29091 are from Requa and Nos. 29219 to 29230 were collected at Crescent City.

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals
29076	♂	19—19—17	158	79	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2
29077	♀	19—19—17	160	70	8—8	9—9	1—1	3—3	1—1	1+2+3—1+2+3
29078	♀	19—19—17	159	69	8—8	8—9	1—1	3—3	1—1	1+2———1+2
29079	♀	19—19—17	153	67	8—7	9—10	1—1	3—3	1—1	1+2+2—1+2+2
29080	♀	19—19—17	147	66	8—8	9—9	1—1	3—3	1—1	1+3———1+2+2
29081	♂	19—19—17	158	80	7—7	9—9	1—1	3—3	1—1	1+3———1+2
29082	♀	19—19—17	156	69	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2
29085	♀	19—19—17	153	71	7—7	10—9	1—1	3—3	1—1	1+2+2—1+2+2
29090	♂	19—19—17	157	76	7—7	8—9	1—1	3—3	1—1	1+2+1—1+2+2
29091	♀	19—19—17	147	60	7—7	9—9	1—1	3—3	1—1	1+2+2—1+2+2
29219	♀	19—19—17	148	74	8—8	9—9	1—1	3—2	1—1	1+2+2—1+2+2
29220	♂	19—19—17	154	34+	7—7	7—8	1—1	3—2	1—1	1+2+2—1+2+2
29221	♀	19—19—17	151	72	8—8	10—9	2—2	3—3	1—1	1+2+1—1+2+2
29223	♀	19—19—17	157	74	8—8	9—8	1—1	3—3	1—1	1+2———1+2
29224	♂	19—19—17	163	97	7—7	10—10	1—1	3—3	1—1	1+1+2—1+2+2
29225	♀	19—19—17	157	65	8—8	9—10	1—1	3—3	1—1	1+2+2—1+2+2
29226	♀	19—19—17	158	64	8—8	10—10	1—1	2—3	1—1	1+3+3—1+3+3
29227	♀	19—19—17	151	82	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2
29228	♀	19—19—17	153	70	8—8	9—10	1—1	3—3	1—1	1+2+2—1+2+2
29229	♀	19—19—17	149	69	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2
29230	♀	19—19—17	150	63	8—7	9—10	1—1	3—3	1—1	1+2+2—1+2+2

It now is well known that variation in the coloration of the snakes of this subspecies is very great. Certain types of coloration may be pointed out as occurring in groups of specimens. The best known of these color types, perhaps, is that in which the general color is dark olive, lateral lines absent, dorsal line yellow and very broad, throat bright yellow, and belly deep olive or slate with or without a median yellow streak. This is the coloration of the types of this subspecies, which types Cope redescribed as *Eutænia infernalis vidua*. It is not a common style of coloration in this subspecies since we find it more or less well marked in only Nos. SR.21, S1654, S1655, S4322, S5180, SR.68, S1198, S4149, S4155, S1200, S1201,

S1202, S1203, S1204, S5183, SR.7, S4157, S6378, S6380, SR.69, SR.64, SR.65, SR.67, S6520, S5852, S4151, S4152, S4153, and S4307, or in twenty-nine of three hundred and sixty-three specimens, or 8%. All of these specimens are from the San Francisco peninsula, that is to say, from San Mateo, Santa Clara, Santa Cruz, and Monterey counties. They, however, share this area with snakes of various other styles of coloration, and all sorts of intermediate specimens are to be found, so that this seems to be merely a peculiar color phase, although restricted geographically to a small portion of the range of the subspecies.

In certain specimens the dorsal line is lacking, or very faint or short. This is found most frequently in specimens from Humboldt and Mendocino counties.

Specimens from San Francisco and Marin counties usually may be recognized as such by their coloration, which is of a style not peculiar to these areas, but certainly most frequent there. There are three lines, the dorso-lateral region is largely red with dark spots, and the belly often is more or less suffused with bright brick red.

Perhaps the most frequent style of coloration is that which shows three light lines on a brown or olive ground, with the belly yellow or olive. But, as we have said, individual variation in color is enormous.

One specimen (No. C2452) contained a *Bascanion vetustum.* This is the only instance we recall of a snake having been eaten by *Thamnophis.*

Thamnophis ordinoides elegans (Baird & Girard)

Mountain Garter-Snake.

Diagnosis.—Normally with eight supralabials; twenty-one, or sometimes nineteen, rows of scales; dorsal line very distinct, narrow; dorsal spots lacking or not evident, being hidden by the dark ground color, not invading the edges of the dorsal line; gastrosteges rarely marked with black or slate; preocular almost always single; infralabials very rarely more than ten.

Type Locality.—El Dorado County, California.

Synonyms.—Tropidonotus trivittatus Hallowell, 1853; type locality Cosumnes River, California. *Eutænia elegans brunnea* Cope, 1892; type locality Fort Bidwell, California. *Eutænia elegans lineolata* Cope, 1892, (part); no type given.

Range.—Thamnophis ordinoides elegans, as here defined, is a mountain form which appears to be confined to the Sierra Nevada and San Bernardino mountains. In the Sierra Nevada it has been taken on both the east and west slopes. It seems not to occur at the lower levels.

We have examined specimens from the following localities:—

1. Onion Valley, Inyo Co., California.
2. Oroville, Butte Co., Cal.
3. Strawberry Valley, Yuba Co., Cal.
4. Soda Springs Station, Placer Co., Cal. 6,500 feet.
5. Fyffe, El Dorado Co., Cal.
6. Tuolumne Meadows, Tuolumne Co., Cal.
7. Tuolumne Meadows, Yosemite National Park, Cal. at 8,600 feet.
8. Tamarack Flat, Mariposa Co., Cal.
9. Yosemite Valley, Mariposa Co., Cal.
10. Yosemite National Park, Cal., at 7,700 feet.
11. Kings River, Fresno Co., Cal., at 5,000 feet.
12. Sierra Nevada Mountains, Tulare Co., Cal.
13. Little Truckee River, Sierraville, Sierra Co., Cal.
14. Fallen Leaf Lake, El Dorado Co., Cal.
15. Lake Tahoe, El Dorado Co., Cal.
16. Tallac, El Dorado Co., Cal.
17. Glenbrook, Douglas Co., Nevada.
18. Farrington's, Mono Lake, Cal.
19. San Bernardino Mountains, San Bernardino Co., Cal.
20. West Fork Deep Creek, San Bernardino Co., Cal.

Of the specimens from the San Bernardino Mountains, number C761 is from Seven Oaks, altitude 5,000 feet; number C4316 is from Santa Ana Canyon, altitude 5,900 feet; number C758 is from the South Fork of the Santa Ana River, altitude 6,200 feet; numbers C759, C965 and C966 are from Fish Creek, altitude 6,500 feet; number C760 is from Bear Lake,

altitude 6,700 feet; and number C967 is from the south side of Sugar Loaf, altitude 6,700 feet.

Three of the specimens from Tulare County (Nos. C2810, C2811 and C2812) were collected at Jackass Meadow, at an altitude of 7,750 feet. The other specimen (C2813) was secured at Monache Meadow, altitude 8,000 feet.

Material.—We have studied ninety-seven specimens from these localities.

Variation.—These specimens show the following variations:

The loreal is 1—1 in all. The preoculars are 1—1 in eighty-nine, or 93%; 1—2 in five, or 5%; and 2—2 in two, or 2%. The postoculars are 3—3 in ninety-two, or 95%; 3—4 in four, or 4%; 2—3 in one, or 1%. The temporals are 1+2—1+2 in seventy-one, or 75%; 1+2—1+3 in sixteen, or 17%; 1+3—1+3 in seven, or 7%; and 1+1—1+1 in one, or 1%. The supralabials are 8—8 in ninety-one, or 94%; 7—8 in two, or 2%; 8—9 in one, or 1%; 9—9 in one, or 1%; and 7—6 in one, or 1%. The infralabials are 10—10 in eighty-two, or 85%; 9—10 in ten, or 10%; 9—9 in two, or 2%; 8—10 in one, or 1%; 10—11 in one, or 1%; and 11—11 in one, or 1%. The scale-rows are 19—19—17 in twenty-two, or 23%; all the others (77%) have 21 rows of scales, but the formula varies, being 19—21—19—17 in thirty, 21—19—17 in seventeen, 21—21—17 in twelve, 19—21—17 in twelve, and 20—21—17 in two. The gastrosteges vary from 151 to 179, males having from 159 to 179, females from 151 to 175; the average in fifty males is 171, in forty-six females, 163.4. The urosteges vary from 70 to 101, males having from 78 to 101, females from 70 to 88, the average in forty males is 86.4, in thirty females, 78.5.

This variation is shown in full in the following table of scale-counts.

Scale counts in *Thamnophis ordinoides elegans*

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Local-ity
C3717	♀	19—19—17	166	27+	8—8	9—10	1—1	3—3	1—1	1+2—1+2	1
C4002	♂	19—19—17	169	86c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	2
C4003	♂	21—21—17	176	83c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	2
C4004	♂	19—19—17	170	86c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	2
S6308	♂	19—21—19—17	170	85c	8—8	10—11	1—1	3—3	1—1	1+3—1+2	3
C5345	♂	19—21—17	...	87c	—8	10—10	1—1	3—3	1—1	——1+2	4
S4370	♂	20—21—17—17	169	84+	8—8	10—10	1—1	4—3	1—1	1+2—1+2	5
S4371	♀	19—21—17—17	157	73c	8—8	10—10	1—1	3—3	1—1	1+3—1+2	5
S1664	♀	19—19—17—17	170	35+	8—8	9—9	X—X	3—3	1—1	1+2—1+2	6
C5906	♂	19—19—17—17	174	89c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	7
C5907	♀	19—19—17—17	172	64+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	7
C5908	♂	19—19—17—17	173	90c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	7
C5909	♂	19—19—17—17	176	91c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	7
C5910	♀	19—19—17—17	164	77c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	7
S4222	♂	19—21—19—17	167	85c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	8
S1689	♂	19—19—17—17	170	90c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	9
C6087	♀	19—19—17—17	167	70c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	10
C6266	♂	19—19—17—17	174	87c	7—8	8—10	1—1	4—3	1—1	1+2—1+2	11
C6267	♂	19—19—17—17	179	101c	8—8	10—10	1—1	3—3	1—1	1+2——	11
C6268	♂	19—19—17—17	174	88c	7—6	10—10	1—1	3—3	1—1	1+2—1+2	11
C6269	♂	19—19—17—17	163	89c	8—8	9—10	1—1	3—3	1—1	1+2—1+2	11
C6270	♂	19—19—17—17	173	87c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	11
C6271	♂	19—21—19—17	170	92c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	11
C6272	♀	19—21—19—17	168	83c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	11
C6273	♀	19—21—19—17	165	76+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	11
C6274	♂	19—19—17—17	177	90c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	11
C6275	♂	19—19—17—17	179	81c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	11
C2810	♂	19—21—17	174	84c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	12
C2811	♂	21—21—17	168	84c	8—8	9—10	1—1	3—3	1—1	1+2—1+2	12
C2812	♀	21—21—17	167	74c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	12
C2813	♂	19—21—17	168	88c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	12
S6305	♀	21—21—19—17	168	88c	8—8	10—10	1—1	3—3	1—1	1+2—1+3	13
S5312	♂	19—19—19—17	178	56+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	14
S6546	♀	21—21—19—17	168	78c	9—9	10—10	1—1	3—3	1—1	1+2—1+2	15
S6531	♀	19—21—19—17	165	80c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	16
S6533	♀	19—21—19—17	167	78c	8—8	9—10	1—1	3—3	1—1	1+2—1+2	16
S6534	♀	19—21—19—17	164	85c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	16
S6535	♀	19—21—19—17	164	85c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	16
S6536	♀	19—21—19—17	169	89+	8—8	9—10	1—1	3—3	1—1	1+2—1+2	16
S6537	♂	19—21—19—17	172	59+	8—8	10—10	1—1	3—3	1—1	1+2—1+3	16
S6538	♀	19—21—19—17	169	66+	8—8	10—10	1—1	3—3	1—1	1+2—1+3	16
S6540	♀	19—21—19—17	169	78c	8—8	11—11	1—1	3—3	1—1	1+3—1+3	16
S6547	♂	19—21—19—17	171	88c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	16
S6549	♀	19—21—19—17	164	75+	8—8	10—10	1—1	3—3	1—1	1+2—1+3	16
S6550	♂	19—21—19—17	170	82c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	16
S6551	♂	19—21—19—17	170	89c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	16
S6555	♂	19—19—19—17	166	42+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	16
S6556	♀	19—21—19—17	164	82c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	16
S6557	♂	19—21—19—17	175	95c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	16
S6562	♀	19—21—19—17	163	88+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	16
S6573	♀	19—21—19—17	163	82c	8—8	9—10	1—1	3—3	1—1	1+2—1+2	16
S6574	♀	19—21—19—17	165	69+	8—9	10—10	1—1	3—3	1—1	1+2—1+2	16
38000	♀	19—21—19—17	173	87c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	17
38001	♂	19—21—19—17	168	54+	8—8	10—9	1—1	3—3	1—1	1+2—1+2	17
38002	♀	19—21—19—17	166	84c	8—8	10—10	1—1	2—3	1—1	1+1—1+1	17
C6084	♀	19—21—19—17	165	83c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	18
S4379	♂	19—21—17—17	165	85c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
S4380	♂	19—19—17—17	162	85c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
S4381	♀	21—21—19—17	159	72c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
S4382	♀	19—19—19—17	159	72c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
S4383	♀	19—21—19—17	162	72c	8—8	10—9	1—1	3—3	1—1	1+2—1+3	19
S4384	♂	19—21—17—17	161	84c	8—8	10—9	1—1	3—3	1—1	1+3—1+2	19
S4385	♂	19—21—17—17	170	80+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
S4386	♀	19—21—17—17	165	76c	8—8	10—10	1—1	3—3	1—1	1+2—1+3	19
S4387	♀	19—21—19—17	157	72c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
S4388	♀	19—21—17—17	158	69+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
S4389	♂	19—21—17—17	166	88c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
S5218	♂	21—21—19—17	161	84c	8—8	10—10	1—1	3—4	1—1	1+2—1+2	19
S5219	♂	21—21—19—17	159	75+	8—7	9—9	2—2	3—3	1—1	1+3—1+2	19
S5220	♀	21—21—19—17	156	72+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
S5221	♂	21—21—19—17	162	83c	8—8	10—10	2—1	3—3	1—1	1+2—1+2	19
S5222	♂	21—21—19—17	166	86c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
S5223	♂	21—21—19—17	169	84+	8—8	10—10	1—1	3—3	1—1	1+3—1+2	19
S5224	♀	21—21—19—17	162	86+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
S5225	♂	21—21—19—17	168	80+	8—8	10—10	2—2	3—3	1—1	1+2—1+2	19

Scale counts in *Thamnophis ordinoides elegans*—Continued

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Local-ity
85226	♂	21—21—19—17	161	78c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
85227	♂	21—21—19—17	168	86+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
85228	♀	19—21—19—17	160	33+	8—8	10—10	1—1	3—3	1—1	1+3—1+3	19
85229	♀	21—21—19—17	151	61+	8—8	10—10	1—1	3—3	1—1	1+3—1+2	19
85230	♀	21—21—19—17	153	73c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
85231	♂	21—21—19—17	164	84c	8—8	10—10	1—2	3—3	1—1	1+3—1+2	19
85232	♀	21—21—19—17	155	74c	8—8	10—10	1—1	3—4	1—1	1+2—1+2	19
C710	♂	21—21—17	166	84c	8—8	10—10	1—1	3—3	1—1	1+3—1+3	19
C711	♀	20—21—17	159	73c	8—8	10—10	1—1	3—3	1—1	1+3—1+3	19
C712	♂	21—21—17	163	85c	8—8	10—10	1—1	3—3	1—1	1+3—1+3	19
C713	♀	21—21—17	159	83c	8—8	10—10	1—2	3—3	1—1	1+2—1+2	19
C758	♂	19—21—17	168	85c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
C759	♀	21—21—17	175	88c	8—8	10—10	1—2	3—3	1—1	1+3—1+2	19
C760	♀	21—21—17	157	78c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
C761	♀	21—21—17	161	73c	8—8	10—10	1—1	3—3	1—1	1+3—1+3	19
C965	♂	19—21—17	169	86c	8—8	10—9	2—1	3—3	1—1	1+3—1+3	19
C966	♀	19—21—17	164	82c	8—8	10—10	1—1	3—3	1—1	1+3—1+2	19
C967	♂	21—21—17	164	83c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
C968	♂	19—21—17	164	70+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
C969	♀	21—21—17	159	29+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
C4316	♂	21—21—17	164	82c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
85166	♀	21— ?—17	165	50+	8—8	10—10	1—1	3—3	1—1	1+2—1+3	20

Remarks.—*Thamnophis ordinoides elegans* is a dark, distinctly striped form with no, or but little, evident spotting, and usually without dark pigmentation of the gastrosteges. It is closely related to *T. o. vagrans* and to *T. o. couchii,* agrees closely with both in most scale characters, and, at certain points, intergrades with both. Thus, some of the specimens from the Warner Mountains, Modoc County, California, approach the *elegans* type of coloration in varying degrees, while others are fairly typical of *vagrans,* under which heading they are listed. Apparently the type of Cope's *Eutænia elegans brunnea* from Fort Bidwell, Modoc County, was such an intermediate specimen. Certain specimens from the Yosemite Valley, Kings River, and Jackass Meadow, are more or less intermediate between *T. o. elegans* and *T. o. couchii.* A few of the specimens from the east slope of the Sierra Nevada also seem to be intergrades. However, the snakes from the higher altitudes in the Sierra Nevada seem to be constantly true to type. Those from the San Bernardino Mountains also show no departure from this type, although their range is in part overlapped by that of *T. o. hammondii.* No one could question the validity of this race as it occurs in these southern mountains, and the fact that intergrades between it and other races occur in the more northern portion of its range should not cause us to refuse it recognition.

We formerly confused this form and the striped race from the coast of California, describing both as *T. elegans.* Although they are rather similar in appearance, they differ in a number of respects. The mountain form usually has twenty-one rows of scales, while the coast subspecies usually has nineteen. The average number of gastrosteges in *T. o. elegans* also is greater, the dorsal line is narrower, and we have never seen any red in the coloration of *T. o. elegans.* Just where and how these two forms meet has yet to be worked out. So far as we now know the one is confined to the interior mountains and the other to the coast region. Between them lies the area occupied by *T. o. couchii* in the north and *T. o. hammondii* in the south. *T. o. couchii* and *T. o. hammondii* are mainly to be found in the Lower and Upper Sonoran zones while the striped snakes are more characteristic of the cooler zones of the mountains and coast.

Thamnophis ordinoides vagrans (Baird & Girard)

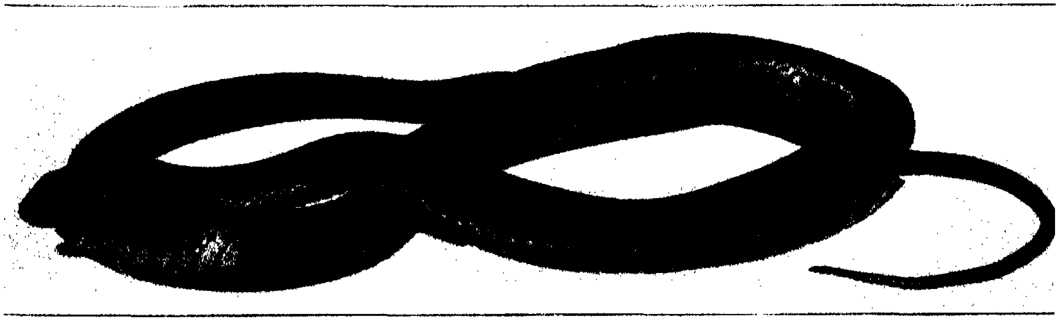
Wandering Garter-Snake.

Diagnosis.—Normally with eight supralabials; twenty-one rows of scales; dorsal line distinct; ground color light with distinct dorsal spots which invade the edges of the dorsal line; gastrosteges marked with black or slate along their anterior edges and medially; preocular single.

Type Locality.—California.

Synonyms.—This race seems to have served as the basis of no other names.

Range.—This subspecies, in typical form, is found over eastern Washington and Oregon, ranging thence east across Idaho to Utah, south across Nevada to eastern California in the vicinity of Mono Lake, and to northern Arizona, where it has been taken at Oak Creek, Fort Verde, Fort Whipple, San Francisco Mountains, Mineral Spring and Prescott. Typical specimens are at hand also from the San Pedro Martir Mountains in northern Lower California, Mexico.



Thamnophis ordinoides vagrans, Wandering Garter-Snake:—Photograph from living specimen collected in Provo Canyon, Wasatch Mountains, Wasatch County, Utah, in June, 1913.

We have examined specimens from the following localities:—

1. Diamond Lake, Stevens Co., Washington.
2. Prescott, Walla Walla Co., Wash.
3. Wallula, Walla Walla Co., Wash.
4. Humpeg Falls, Columbia Co., Wash.
5. Buck Creek, Lake Co., Oregon.
6. Bridge Creek, Lake Co., Ore.
7. Silver Creek, Harney Co., Ore.
8. Burns, Silvies River, Harney Co., Ore.
9. Umatilla, Umatilla Co., Ore.
10. Wallowa, Wallowa Co., Ore.
11. Mono Lake, Mono Co., California.
12. Walker Lake, Mono Co., Cal.
13. Winnemucca Lake, Washoe Co., Nevada.
14. Pine Forest Mountains, Humboldt Co., Nev.
15. Quinn River Crossing, Humboldt Co., Nev., at 4,100 feet.
16. Virgin Valley, Humboldt Co., Nev.
17. Smoky Valley, Nye Co., Nev. 20 miles north of Round Mountain.
18. Near Palisade, Eureka Co., Nev.
19. Elko, Elko Co., Nev.
20. Blue Lake, Twin Falls Co., Idaho.
21. Wardner, Shoshone Co., Idaho.
22. Potlatch Creek, 2 miles above mouth, near Lewiston, Nez Perce Co., Idaho.
23. Clearwater River, 7 miles above Lewiston, Nez Perce Co., Idaho.
24. Weiser, Washington Co., Idaho.
25. Boise, Ada Co., Idaho.
26. Payette Lake, Boise Co., Idaho.
27. Near head of Malad River Canyon, Blaine Co., Idaho.
28. Near Ketcham, Blaine Co., Idaho.
29. Guyer Hot Springs, Blaine Co., Idaho.
30. Near Shoshone Falls, Lincoln Co., Idaho.
31. Plains south side Snake River near Salmon Falls, Twin Falls Co., Idaho.
32. Cottonwood Creek, Cassia Co., Idaho.
33. Arco, Blaine Co., Idaho.

34. Fort Hall, Bingham Co., Idaho.
35. Bear River, Logan, Cache Co., Utah.
36. Woods Cross, Morgan Co., Utah.
37. Oak Creek, Coconino Co., Arizona.
38. San Pedro Martir Mountains, Lower California, Mexico.

Material.—One hundred specimens have been included in the present study.

Variation.—The variations shown by these specimens are as follows:

The loreal is 1—1 in all specimens. Preoculars 1—1 in eighty-one, or 81%; 2—2 in thirteen, or 13%; 1—2 in five, or 5%; and 2—3 in one, or 1%. Postoculars are 3—3 in eighty-eight, or 88%; 2—3 in four, or 4%; 3—4 in four, or 4%; 4—4 in three, or 3%; and 2—2 in one, or 1%. Temporals are 1+2—1+2 in sixty-seven, or 67%; 1+2—1+3 in twenty, or 20%; and 1+3—1+3 in thirteen, or 13%. The supralabials are 8—8 in eighty-nine, or 89%; 7—8 in eight, or 8%; and 7—7 in three, or 3%. The infralabials are 10—10 in eighty-six, or 86%; 9—10 in seven, or 7%; 10—11 in four, or 4%; 9—8 in one, or 1%; and 11—11 in one, or 1%. The scale-rows are 21—21—17 in fifty-five, or 55%; 21—19—17 in thirty-three, or 33%; 19—21—19—17 in four, or 4%; 19—21—17 in three, or 3%; 19—19—17 in one, or 1%; 20—21—19—17 in one, or 1%; and 20—21—17—17 in one, or 1%. The gastrosteges vary in number from 148 to 182, males having from 159 to 182, females from 148 to 177; the average in fifty-three males is 174.2, in forty-seven females, 169. The urosteges vary from 67 to 95, males having from 79 to 95, females from 67 to 83; the average in forty-four males is 86, in thirty-five females, 76.

This variation is shown in full in the following table of scale-counts.

Scale counts in *Thamnophis ordinoides vagrans*

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Local-ity
S2664	♀	19—21—19—17	163	74c	—8	......	1—1	3—3	1—1	1+2—1+2	1
C5584	♂	21—21—19—17	174	84c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	2
C5583	♂	21—21—19—17	173	89c	7—7	10—10	1—1	3—3	1—1	1+2—1+2	3
C5582	♀	21—21—19—17	172	83c	7—7	10—10	1—1	4—3	1—1	1+2—1+2	3
C5585	♂	21—21—19—17	166	85c	7—8	10—10	2—2	3—3	1—1	1+2—1+2	4
S6317	♀	21—21—17—17	172	77c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	5
S5261	♂	21—21—X—X	X	X	8—8	10—9	2—2	3—3	1—1	1+3—1+3	6
S6502	♀	21—21—X—17	170	71+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	6
S6503	♂	21—21—17—17	179	85c	8—7	10—10	1—1	3—3	1—1	1+2—1+2	6
S6504	♀	21—21—17—17	172	74c	8—8	10—10	2—1	3—3	1—1	1+2—1+3	6
S5234	♂	21—21—17—17	176	90c	8—8	9—8	2—2	3—3	1—1	1+2—1+2	7
S6316	♀	21—21—17—17	172	70+	8—7	9—10	1—1	2—3	1—1	1+2—1+2	8
S1660	♀	21—21—19—17	166	76c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	9
S4063	♀	19—21—17—17	164	76c	8—8	10—10	1—1	3—3	1—1	1+3—1+2	10
C6085	♀	21—21—19—17	166	76c	8—8	9—10	1—1	3—3	1—1	1+2—1+2	11
C6086	♂	19—19—17—17	175	79c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	11
C6083	♂	19—21—19—17	174	92c	8—8	10—10	1—1	3—3	1—1	1+2—1+3	11
C5958	♀	21—21—19—17	162	52+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	12
S6525	♀	21—21—19—17	166	74c	8—8	11—11	1—1	3—3	1—1	1+2—1+2	13
C1520	♀	21—21—17	176	55+	8—8	10—10	1—1	3—3	1—1	1+2—1+3	14
C1521	♂	21—21—17	178	27+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	14
C1522	♂	21—21—17	182	81c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	14
C1523	♀	21—21—17	173	82c	8—8	10—10	3—2	3—3	1—1	1+2—1+2	14
C1524	♂	21—21—17	177	86c	8—8	10—10	2—2	3—3	1—1	1+2—1+2	14
C1525	♂	21—21—17	180	93c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	14
C1517	♂	21—21—17	178	82c	8—8	10—10	2—2	3—3	1—1	1+2—1+2	15
C1518	♂	21—21—17	179	80c	8—8	10—10	2—2	4—3	1—1	1+2—1+2	15
C1519	♂	19—21—17	178	85c	8—8	10—10	2—2	4—4	1—1	1+2—1+2	15
C1526	♀	21—21—17	176	72c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	15
C1527	♀	21—21—17	171	72c	7—8	10—10	1—1	3—3	1—1	1+3—1+3	15
C1271	♀	21—21—17	174	81c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	16
47995	♀	21—19—17	166	68+	8—8	10—10	1—1	2—2	1—1	1+3—1+2	17
S6530	♀	21—21—19—17	177	77+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	18
S6558	♀	21—21—19—17	175	83c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	18
S6559	♂	21—21—21—17	174	73+	8—8	10—10	1—1	3—3	1—1	1+2—1+3	18
S6565	♀	20—21—19—17	173	58+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	18
S6566	♀	21—21—19—17	171	80c	8—8	10—10	1—1	3—3	1—1	1+3—1+2	18
S6567	♀	21—21—19—17	170	75c	8—8	10—10	1—1	3—2	1—1	1+2—1+2	18
S6568	♂	21—21—19—17	173	87c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	18
S6569	♂	21—21—21—17	175	82c	8—8	10—10	1—1	3—3	1—1	1+3—1+3	18
S6570	♀	21—21—21—17	169	73c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	18
S6572	♀	21—21—21—17	174	78c	8—8	11—10	1—1	3—3	1—1	1+2—1+2	18
37829	♂	21—21—17—17	179	51+	8—8	10—10	2—2	3—3	1—1	1+2—1+2	19
37830	♀	21—21—17—17	171	45+	8—8	11—10	1—1	3—3	1—1	1+3—1+3	19
37831	♂	21—21—17—17	177	88c	8—8	10—10	2—2	3—3	1—1	1+3—1+2	19
37832	♀	21—19—17—17	173	77c	8—8	10—10	1—1	3—3	1—1	1+3—1+3	19
37833	♂	21—21—17—17	177	47+	8—8	10—10	2—1	3—3	1—1	1+3—1+2	19
37834	♀	21—21—17—17	161	44+	8—8	10—10	1—1	3—3	1—1	1+3—1+3	19
37835	♂	21—21—17—17	173	88c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
37836	♂	21—21—17—17	176	87c	8—8	10—10	2—2	3—3	1—1	1+2—1+2	19
37837	♂	21—21—17—17	181	85c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
37838	♂	21—21—19—17	179	95c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
37839	..	21—21—17—17	169	....	8—8	10—10	1—1	3—3	1—1	1+3—1+3	19
37840	♂	21—21—19—17	182	88c	8—7	10—9	1—1	3—3	1—1	1+2—1+2	19
40936	♂	21—21—17—17	177	85c	8—8	10—10	1—1	3—3	1—1	1+3—1+3	19
40937	♂	21—21—17—17	172	80c	8—8	10—11	1—1	3—3	1—1	1+3—1+2	19
40938	♂	21—21—17—17	180	86c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
40939	♀	21—21—17—17	174	79c	8—8	10—10	1—1	3—3	1—1	1+2—1+3	19
40940	♂	21—21—17—17	179	91c	8—8	10—10	2—2	3—3	1—1	1+3—1+2	19
40941	♂	21—21—17—17	177	85c	8—8	10—10	1—1	3—3	1—1	1+2—1+3	19
40942	♂	21—21—17—17	181	86c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
40943	♂	21—21—17—17	180	89c	8—8	10—10	1—2	3—3	1—1	1+3—1+3	19
40944	♂	21—21—17—17	177	85c	8—8	10—10	1—1	3—3	1—1	1+3—1+2	19
40945	♀	21—21—17—17	177	66+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	19
S2665	♀	19—21—17—17	160	70c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	20
S2666	♀	21—21—17—17	161	71c	8—8	10—10	1—1	3—3	1—1	1+3—1+3	20
S2667	♂	19—21—19—17	159	83c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	20
S1658	♂	19—21—19—17	166	82+	8—8	10—10	1—1	3—2	1—1	1+2—1+2	21
S1661	♂	21—21—17—17	167	87c	8—8	10—10	1—1	3—3	1—1	1+3—1+3	22
S1659	♂	21—21—17—17	172	80c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	23
S1687	♂	20—21—17—17	172	89+	7—8	10—10	1—1	3—3	1—1	1+2—1+2	24
S1688	♂	21—21—19—17	172	91c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	24
41364	♂	21—21—19—17	172	68+	8—8	10—10	1—1	3—2	1—1	1+2—1+2	25
41365	♀	21—21—19—17	171	83c	8—8	10—10	1—1	3—3	1—1	1+3—1+2	25
43531	♀	21—21—17—17	169	83c	8—8	10—10	1—1	4—4	1—1	1+2—1+2	25

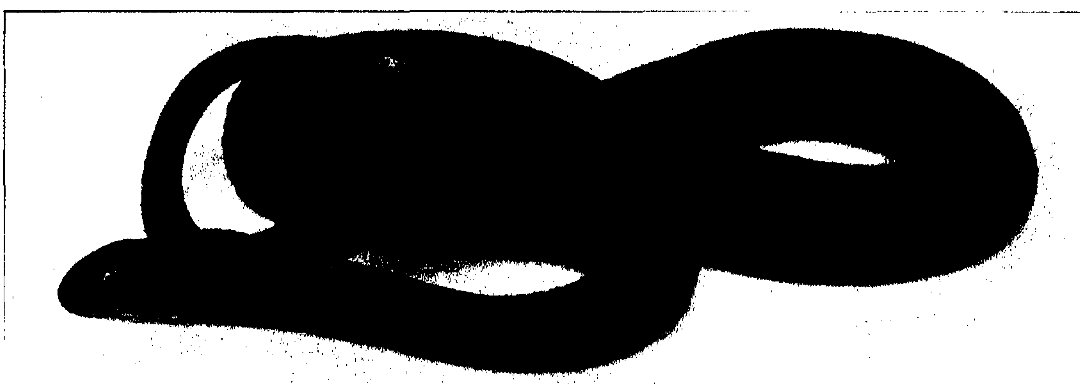
Scale counts in *Thamnophis ordinoides vagrans*—Continued

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Local-ity
41576	♂	21—21—19—17	170	79+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	26
41577	♂	21—21—17—17	171	79+	8—8	10—10	1—1	4—3	1—1	1+2—1+2	26
41578	♂	21—21—19—17	167	89c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	26
41579	♀	21—21—19—17	167	79c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	26
S4066	♀	21—21—17—17	172	86c	8—8	10—11	1—1	4—4	1—1	1+2—1+2	27
S4067	♀	21—21—19—17	167	82c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	27
S4060	♀	21—21—17—17	165	71c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	28
S4061	♂	21—21—17—17	164	87c	8—8	10—10	2—2	3—3	1—1	1+3—1+2	28
41582	♀	21—21—19—17	170	77c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	29
41583	♀	21—21—19—17	165	77c	8—8	10—10	2—1	3—3	1—1	1+2—1+2	29
S4055	♂	21—21—17—17	170	87c	8—8	10—10	1—1	3—3	1—1	1+3—1+2	30
S4056	♀	21—21—19—17	172	72c	8—8	10—10	1—1	3—3	1—1	1+3—1+3	30
S4057	♂	21—21—17—17	168	84c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	30
S4051	♂	21—21—21—17	170	88c	7—8	10—10	1—2	3—3	1—1	1+2—1+2	31
S4058	♂	21—21—17	175	91c	8—8	10—10	1—1	3—3	1—1	1+3—1+3	32
S4054	♀	21—21—17—17	176	75c	8—8	10—10	1—1	3—3	1—1	1+3—1+2	33
41271	♂	21—21—19—17	174	83c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	34
41272	♀	21—21—19—17	169	71c	8—8	10—10	1—1	4—3	1—1	1+3—1+2	34
41273	♂	21—21—19—17	175	90c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	34
41274	♀	21—21—19—17	175	80c	8—8	10—9	1—1	3—3	1—1	1+2—1+3	34
S1779	♀	21—21—19—17	170	72c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	35
40402	♀	21—21—17—17	168	73c	8—8	9—10	2—2	3—3	1—1	1+2—1+2	36
35266	♀	21—19—17	148	76c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	37
S1721	♂	19—21—17	160	80c	7—7	10—10	1—1	3—3	1—1	1+2—1+2	38
S1722	♀	21—19—17	150	67c	8—7	10—9	1—1	3—3	1—1	1+2—1+2	38

Remarks.—This subspecies remains remarkably true to its peculiar color characters throughout the vast area which constitutes the greater portion of its range. It is only along the western edge of this area that much variation occurs. Specimens from western Nevada and from eastern California vary towards *T. o. biscutatus, T. o. couchii* and *T. o. elegans,* so that it may be said that intergradation with all these forms occurs. Thus, specimens from Humboldt County, Nevada, frequently have two preoculars as in *T. o. biscutatus,* and certain specimens from near Lake Tahoe leave one in doubt as to whether they might best be referred to *T. o. vagrans, T. o. couchii* or even *T. o. elegans.*

The two specimens from the San Pedro Martir Mountains in northern Lower California, which formerly were referred to *T. hammondii,* are very typical *vagrans* in coloration, but have low gastrostege counts. They constitute by far the most southern record for this subspecies and offer an interesting problem in distribution, for *T. o. vagrans* has never been taken in southern California.

The snakes taken at Elko, Nevada, had been feeding on the larvæ of *Rana pipiens.*



Thamnophis ordinoides biscutatus, Klamath Garter-Snake:—Photograph from living specimen collected at Klamath Falls, Klamath County, Oregon, June 14, 1918.

The specimens from the Pine Forest Mountains, Nevada, were collected at altitudes of 4300, 6000, 7800, and 8400 feet.

Eleven specimens from the Warner Mountains, Modoc County, California, collected at altitudes of from 5000 to 7300 feet on Parker Creek and Squaw Peak (Nos. C2164 to 2179) have not been included in the analysis given above. No. 2164 has the coloration of nearly typical *T. o. vagrans.* The others show various degrees of approach to the coloration of *T. o. elegans.* No. C2166 is very close to the *elegans* style. No. C2168 is similar in coloration to the Klamath Falls snakes, but all of these Warner Mountain specimens have single preoculars. It is probable that the type of Cope's *Eutænia elegans brunnea,* from Fort Bidwell, Modoc County, is such a specimen. Scale-counts of the Warner Mountain specimens are as follows:

Number	Sex	Scale rows	Gastrosteges	Urosteges	Supralabials	Infralabials	Preoculars	Postoculars	Loreals	Temporals
C2164	♀	21—21—17	171	78	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2
C2165	♂	21—21—17	176	84	8—8	10—10	1—1	3—3	1—1	————1+2+3
C2166	♂	21—21—17	178	94	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3
C2167	♂	21—21—17	188	59+	8—7	10—10	1—1	3—3	1—1	1+2+3—1+2+3
C2168	♀	21—21—17	171	79	8—8	10—9	1—1	3—3	1—1	1+2+3—1+2+3
C2169	♀	21—21—17	172	78	8—8	10—10	1—1	3—3	1—1	1+3+3—1+2+3
C2170	♂	19—19—17	175	77	8—7	......	1—1	3—3	1—1	1+2+2—1+2+2
C2171	♂	21—21—17	177	87	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2
C2172	♀	21—21 17	171	79	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3
C2173	♀	21—21—17	168	80	8—8	10—10	1—1	3—4	1—1	1+2+3—1+2+3
C2179	♀	21—21—17	171	81	8—8	10—10	1—1	3—3	1—1	....

Thamnophis ordinoides biscutatus (Cope)

Klamath Garter-Snake.

Diagnosis.—Normally with eight supralabials; twenty-one or twenty-three rows of scales; dorsal line distinct; dorsal spots invading edges of dorsal line but often not showing by reason of the dark ground color; often with dark markings on the gastrosteges; usually more than one preocular.

Type Locality.—Klamath Lake, Oregon.

Synonyms.—It is probable that Yarrow's *Eutænia Henshawi* from Fort Walla Walla, Washington, may have been based upon a specimen of this subspecies. Ruthven included these snakes under the name *T. o. elegans.*

Range.—This subspecies is or was exceedingly abundant about the Klamath lakes. Thence it ranges east to Goose Lake, Modoc County, California, west to Josephine County, Oregon, and Del Norte County, California. Farther north it occurs near Puget Sound, Washington, and in British Columbia.

We have examined specimens from the following localities:—

1. Lillooet River Valley, British Columbia.
2. San Juan Islands, San Juan Co., Washington.
3. Rogue River, Grants Pass, Josephine Co., Oregon.
4. South Fork, Coquille River, 20 miles above Myrtle Point, Coos Co., Ore.
5. Gasquet, Del Norte Co., California.
6. Klamath Falls, Klamath Co., Ore.
7. Lower Klamath Lake, Siskiyou Co., Cal.
8. Goose Lake, Modoc Co., Cal.
9. Davis Creek, Modoc Co., Cal.

Material.—More than two hundred and fifty specimens have been studied by us.

Variation.—The variations shown by these specimens are as follows:

The loreal is 1—1 in all specimens. Preoculars are 2—2 in one hundred and fifty-nine, or 63%; 1—2 in twenty-five, or 10%; 1—1 in sixty-three, or 25%; and 2—3 in one. Postoculars are 3—3 in two hundred and thirteen, or 80%; 3—4 in twenty-six, or 10%; 4—4 in five, or 2%; 2—3 in three, or 1%; and 4—1 in one. Temporals are 1+2—1+2 in one hundred and ninety, or 77%; 1+3—1+3 in sixteen, or 6%; 1+2—1+3 in thirty-nine, or 15%. The supralabials are 8—8 in two hundred and thirty-two, or 92%; 7—8 in eleven, or 4%; and 7—7 in four, or 1%. The infralabials are 10—10 in two hundred and twenty-two, or 88%; 9—10 in thirteen, or 5%; 9—9 in eight, or 3%; 10—11 in two, and 8—8 in one. The scale-rows are 21—21—17 in two hundred and sixteen, or 87%; 21—19—17 in nine, or 3%; 21—23—17 in six, or 2%; 21—17—17 in three, or 1%; 19—17—17 in three, or 1%; 19—19—17 in two, 19—17—15 in two, 23—19—17 in two, 23—21—19 in one, 17—17—17 in one, and 20—21—17 in one.

The gastrosteges vary in number from 151 to 183, males having from 157 to 183, females from 151 to 176; the average in one hundred and twenty males is 171, in one hundred and twenty-three females, 166. The urosteges vary from 63 to 97, males having from 76 to 97, females from 63 to 91; the average in one hundred and twelve males is 84, in one hundred and three females, 77. These variations are shown in full in the following table of scale-counts.

Scale counts in *Thamnophis ordinoides biscutatus* (Cope)

Number	Sex	Scale rows	Gastrosteges	Urosteges	Supralabials	Infralabials	Preoculars	Postoculars	Loreals	Temporals	Locality
S5169	♂	19—17—15	166	86c	8—8	10—10	2—2	3—2	1—1	1+2——1+2	1
S5172	♀	21—17—17	156	71c	8—8	9—10	1—1	3—3	1—1	1+2——1+3	1
S5173	♂	21—19—17	169	84+	8—8	10—10	1—1	3—3	1—1	1+2——1+2	1
S5175	♀	21—19—17	164	31+	8—8	10—10	2—2	3—3	1—1	1+3——1+2	1
S6516	♀	23—21—19	158	69c	8—8	11—10	2—2	3—4	1—1	1+3——1+3	2
S4059	♀	21—19—17	162	80c	8—8	10—10	1—1	4—3	1—1	1+3——1+2	3
S4471	♂	19—17—17	158	83c	8—8	10—10	2—2	3—3	1—1	1+2——1+3	4
S4473	♂	19—17—15	157	86c	8—8	8—8	1—1	3—3	1—1	1+2——1+3	4
S4474	♀	17—17—17	151	77c	8—8	9—9	1—1	3—3	1—1	1+3——1+3	4
S4476	♀	19—17—17	156	78c	8—8	10—10	1—1	3—3	1—1	1+3——1+2	4
S4479	♀	19—17—17	159	76c	8—8	10—10	2—1	3—3	1—1	1+3——1+3	4
S4264	♂	21—19—17	166	86c	8—8	10—9	1—1	3—3	1—1	1+3——1+3	5
20161	♂	21—17	170	76	8—8	10—10	1—1	4—3	1—1	1+2+3—1+2+3	6
20162	♂	21—21—17	172	89	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20163	♀	21—21—17	165	79	8—8	10—10	2—2	4—3	1—1	——1+3+3	6
20164	♂	21—21—17	177	91	8—7	9—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20165	♂	21—21—17	175	89	8—8	10—10	2—2	3—3	1—1	1+2+3—1+3+3	6
20166	♂	21—21—17	166	23+	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20167	♀	21—21—17	170	82	8—8	10—10	1—1	4—4	1—1	1+2+3—1+2+3	6
20168	♀	21—21—17	166	44+	8—8	10—10	2—2	4—4	1—1	1+2+3—1+2+3	6
20169	♂	....	176	88	8—8	9—9	2—2	3—3	1—1	1+2+4—1+2+3	6
20170	♀	21—17	164	77	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20171	♀	21—21—17	163	73	8—8	10—10	2—1	3—3	1—1	1+2+3—1+2+3	6
20172	♀	21—23—17	164	78	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20173	♂	....	172	76	8—8	9—9	2—2	3—3	1—1	1+2+3—1+2+3	6
20174	♀	21—21—17	163	77	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20175	♀	19—19—17	164	....	7—7	9—10	1—1	3—3	1—1	1+2+2—1+2+2	6
20176	♂	21—21—17	171	73+	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20177	♂	21—21—17	168	90	7—8	10—10	1—2	3—3	1—1	1+2+3—1+2+3	6
20178	♀	21—21—17	169	78	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20179	♂	21—21—17	175	92	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+4	6
20180	♂	21—21—17	171	63+	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20181	♂	21—21—17	171	86	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20182	♂	21—21—17	172	91	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20183	♂	21—21—17	175	87	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20185	♂	21—21—17	172	41+	8—8	9—10	2—3	1—4	1—1	1+2+3—1+2+3	6
20186	♂	21—21—17	172	90	8—8	10—10	1—2	3—3	1—1	1+2+2—1+2+3	6
20187	♂	21—21—17	175	88	8—8	9—9	1—1	3—3	1—1	1+2+3—1+2+3	6
20189	♂	21—21—17	170	85	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20190	♂	21—21—17	173	79	8—8	10—10	2—2	3—3	1—1	1+2+3——	6
20191	♂	21—21—17	173	83	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20192	♂	21—21—17	167	92	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20193	♂	21—21—17	171	93	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20194	♂	21—21—17	168	86	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20195	♂	21—21—17	169	88	8—8	10—10	2—2	3—3	1—1	1+3+3—1+2+3	6
20197	♂	21—21—17	174	95	8—8	10—10	1—1	4—3	1—1	1+2+3—1+3+3	6
20198	♂	21—21—17	170	88	8—8	10—10	2—2	3—3	1—1	1+3——1+3	6
20199	♂	21—21—17	172	91	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20200	♂	21—21—17	173	75+	8—8	10—10	1—2	3—3	1—1	1+2+2—1+2+3	6
20201	♂	21—21—17	170	86	8—8	10—10	2—2	3—3	1—1	1+3+3—1+3+3	6
20202	♂	21—21—17	174	93	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20203	♀	21—21—17	161	77	8—8	10—10	2—1	4—3	1—1	1+2+3—1+2+3	6
20204	♂	21—21—17	175	86	8—8	10—10	1—2	3—3	1—1	1+2+3—1+2+3	6
20205	♀	21—21—17	163	82	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6

Scale counts in *Thamnophis ordinoides bisculatus* (Cope)—Continued

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Locality
20206	♂	21—21—17	177	87	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20207	♂	21—21—17	174	89	8—8	10—10	2—2	3—3	1—1	1+2+3—1+3+3	6
20208	♂	21—21—17	172	91	8—8	10—10	2—2	3—3	1—1	1+3———1+2	6
20209	♂	21—21—17	173	90	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20210	♂	21—21—17	168	86	8—8	10—10	2—2	3—3	1—1	1+2+3—1+3+3	6
20216	♂	21—21—17	169	93	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20217	♂	21—21—17	165	92	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20218	♂	21—21—17	170	92	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20219	♀	21—21—17	167	78	8—8	10—10	2—1	2—3	1—1	1+2+3—1+2+3	6
20220	♂	21—21—17	173	89	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20221	♂	21—21—17	168	90	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20222	♂	21—21—17	171	87	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20223	♂	21—21—17	169	79	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20224	♀	21—21—17	169	79	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20225	♀	21—21—17	169	73	8—8	9—9	2—2	3—3	1—1	1+2+3—1+2+3	6
20226	♂	21—21—17	170	91	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20227	♂	21—21—17	168	88	8—8	10—10	2—1	3—3	1—1	1+2+3—1+2+3	6
20228	♀	23—19	169	63	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20229	♀	21—21—17	167	77	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20230	♀	21—21—17	167	88	8—8	10—10	1—2	3—4	1—1	1+2+3—1+2+3	6
20231	♀	....	162	86	7—7	9—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20232	♀	21—21—17	165	79	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20233	♂	?—21—?	173	89	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	6
20234	♀	21—21—17	167	84	8—8	9—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20235	♀	21—21—17	163	74	8—8	9—9	2—2	3—3	1—1	1+2+3—1+2+3	6
20236	♀	21—19—17	161	80	8—8	......	2—1	3—3	1—1	1+2+3—1+2+3	6
20237	♂	21—21—17	175	34+	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20238	♂	21—21—17	174	85	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20239	♀	21—21—17	166	75	8—8	10—10	2—2	3—3	1—1	1+2+1—1+2+3	6
20240	♀	21—21—17	161	78	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20241	♀	....	176	91	8—?	10—10	....	....	....	....	6
20242	♀	21—21—17	170	85	8—8	10—10	1—1	2—2	1—1	1+2+3—1+2+3	6
20243	♂	21—21—17	175	87	8—8	10—10	2—2	3—3	1—1	1+3+3—1+3+3	6
20244	♂	21—21—17	180	69+	8—8	10—10	2—2	3—3	1—1	1+2+3—1+3+3	6
20245	♂	21—21—17	168	74+	8—7	9—10	2—2	3—3	1—1	1+2+3———	6
20246	♂	21—21—17	175	90	8—8	10—10	2—2	2—3	1—1	1+2+3—1+2+3	6
20247	♂	21—21—17	171	85	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20248	♂	21—21—17	173	92	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20249	♀	21—21—17	164	72	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20250	♂	21—21—17	172	90	8—8	9—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20251	♂	21—21—17	165	90	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20252	♀	21—21—17	169	76	8—8	10—10	1—1	3—3	1—1	1+2+3—1+3+3	6
20253	♂	21—23—17	173	94	8—8	10—10	2—2	4—4	1—1	1+3+3—1+2+3	6
20254	♀	21—21—17	166	80	8—8	10—10	2—2	3—4	1—1	1+2+3—1+2+3	6
20255	♂	21—21—17	171	84	8—8	10—10	2—2	3—3	1—1	1+3+4—1+2+3	6
20256	♀	21—21—17	166	73+	8—8	10—10	2—1	3—3	1—1	1+3+3—1+3+3	6
20257	♂	21—21—17	174	53+	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20258	♀	21—21—17	164	58+	8—8	10—10	2—1	3—3	1—1	1+2+3—1+2+3	6
20259	♀	21—21—17	170	81	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20260	♂	21—21—17	173	63+	8—8	10—10	2—2	3—3	1—1	1+2+4—1+2+3	6
20261	♀	21—21—17	168	84	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20262	♂	21—21—17	169	93	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20263	♂	21—21—17	171	88	8—8	10—10	2—2	3—3	1—1	1+2+2—1+2+3	6
20264	♀	21—21—17	166	70	8—8	10—10	1—1	3—3	1—1	1+2+3—1+3+4	6
20265	♂	21—21—17	171	90	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20266	♀	21—21—17	164	76	8—8	10—10	2—2	4—3	1—1	1+2+3—1+2+2	6
20267	♀	21—21—17	166	79	8—8	10—10	2—2	4—3	1—1	1+2+3—1+3+3	6
20268	♀	21—21—17	164	79	8—8	10—10	1—1	3—3	1—1	1+2+4—1+3+3	6
20269	♀	21—21—17	168	47+	8—8	10—10	2—2	3—3	1—1	1+3+3—1+2+3	6
20270	♂	21—21—17	173	89	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20271	♀	21—21—17	170	81	8—8	10—10	1—2	4—3	1—1	1+2+3—1+2+3	6
20272	♀	21—21—17	166	80	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20273	♀	21—21—17	160	73	8—8	10—10	1—2	3—3	1—1	1+2+3—1+2+3	6
20274	♂	21—21—17	175	89	8—8	10—10	1—2	3—3	1—1	1+2+3—1+2+3	6
20275	♀	21—21—17	169	75	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20276	♀	21—21—17	170	77	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20277	♂	21—21—17	171	96	7—7	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20278	♀	21—21—17	167	80	8—8	10—10	1—1	4—3	1—1	1+2+3—1+2+3	6
20279	♂	21—21—17	169	90	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+2	6
20280	♂	21—21—17	175	89	8—7	10—10	2—1	3—3	1—1	1+2+2—1+3+3	6
20281	♀	21—21—17	163	75	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20282	♂	21—21—17	174	90	8—8	10—10	2—1	3—3	1—1	1+2+2—1+3+3	6
20283	♂	21—21—17	167	84	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20284	♂	21—21—17	173	90	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20285	♀	21—21—17	167	76	8—8	10—10	2—2	4—3	1—1	1+2+3—1+2+3	6

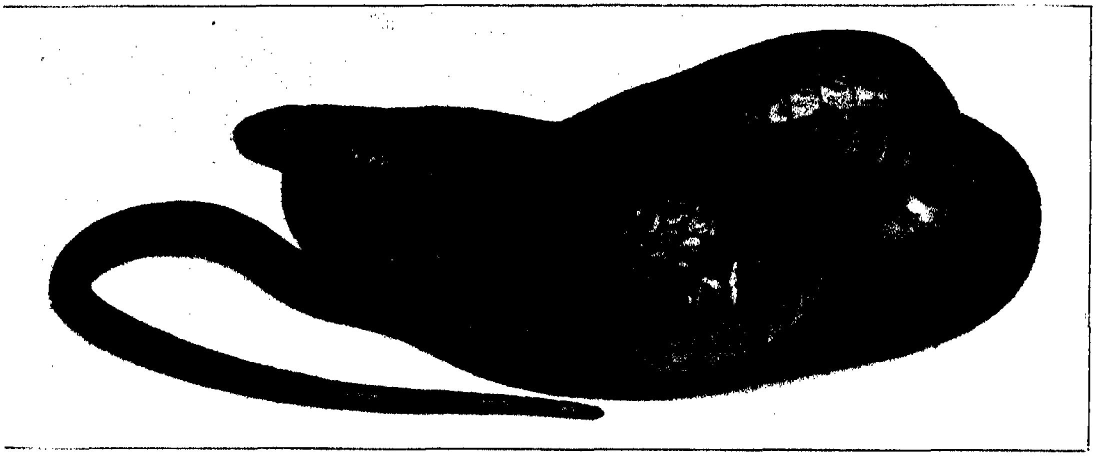
Scale counts in *Thamnophis ordinoides biscutatus* (Cope)—Continued

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Local-ity
20286	♀	21—21—17	173	81	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+2	6
20287	♀	21—21—17	170	86	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20288	♂	21—21—17	173	89	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20289	♂	21—21—17	169	93	8—8	10—10	2—2	3—3	1—1	1+2+2—1+3+3	6
20290	♀	21—21—17	166	78	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+2	6
20291	♀	21—21—17	166	79	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20292	♀	21—21—17	171	93	8—8	10—10	2—2	3—3	1—1	1+3+3—1+2+3	6
20293	♂	21—21—17	171	97	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20294	♂	21—21—17	172	88	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20295	♀	21—21—17	162	81	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20296	♀	21—21—17	164	82	8—8	10—10	2—2	3—3	1—1	1+3+4—1+3+3	6
20297	♀	21—21—17	167	80	8—8	10—10	2—2	3—3	1—1	1+3+3—1+2+3	6
20298	♀	21—21—17	168	73	8—8	10—10	1—1	3—3	1—1	1+2+3—1+3+4	6
20299	♀	21—21—17	166	78	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20300	♀	21—21—17	169	78	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20301	♂	21—21—17	168	96	8—8	10—10	1—1	3—3	1—1	1+3+3—1+2+3	6
20302	♀	21—21—17	172	82	8—8	10—10	1—2	3—3	1—1	1+2+3—1+2+3	6
20303	♂	21—21—17	172	91	8—8	10—10	2—2	3—3	1—1	1+3+3—1+3+3	6
20304	♀	21—21—17	169	83	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20305	♂	21—21—17	178	91	8—8	10—10	1—1	3—3	1—1	1+3+3—1+2+3	6
20306	♂	21—21—17	173	94	7—8	10—10	2—2	3—3	1—1	1+2+3—1+3+3	6
20307	♂	21—21—17	170	87	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20308	♂	21—21—17	176	90	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20309	♂	21—21—17	174	92	7—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20310	♀	21—21—17	164	78	8—8	10—10	1—2	3—3	1—1	1+2+3—1+3+3	6
20311	♀	21—21—17	163	75	7—7	10—9	2—2	3—3	1—1	1+2+3—1+2+3	6
20312	♂	21—21—17	172	90	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20313	♀	21—21—17	170	63+	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20314	♀	21—21—17	164	84	8—8	10—9	1—1	3—3	1—1	1+2+3—1+2+3	6
20315	♂	21—21—17	173	92	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20316	♀	21—21—17	165	85	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20317	♀	21—21—17	170	70	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20318	♀	21—21—17	164	76	8—8	10—10	2—2	4—3	1—1	1+2+3—1+2+3	6
20319	♀	21—21—17	162	82	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20320	♂	21—19—17	171	82	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20321	♀	21—21—17	169	87	8—8	10—10	2—1	3—3	1—1	1+2+3—1+2+3	6
20322	♀	21—21—17	165	78	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20323	♂	21—21—17	167	92	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20324	♀	21—21—17	172	73	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20325	♂	21—21—17	172	88	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20326	♀	21—21—17	163	75	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20327	♀	21—21—17	170	74	8—9	10—10	2—2	3—4	1—1	1+2+3—1+2+3	6
20328	♀	21—21—17	165	87	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20329	♀	21—21—17	167	81	8—8	9—10	2—2	4—3	1—1	1+3——1+2	6
20330	♂	21—21—17	176	87	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20331	♂	21—21—17	167	89	8—8	10—10	2—2	4—3	1—1	1+2+3—1+2+2	6
20332	♀	21—21—17	167	75	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+2	6
20333	♂	21—23—17	169	90	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20334	♂	21—21—17	173	89	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20335	♀	21—21—17	160	73	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20336	♂	21—21—17	166	93	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20337	♂	21—21—17	172	89	8—8	10—10	2—2	3—4	1—1	1+2+3—1+2+3	6
20338	♂	21—21—17	174	94	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20339	♂	21—21—17	171	94	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20340	♀	21—21—17	167	82	8—8	10—10	2—2	3—4	1—1	1+2+4—1+2+4	6
20341	♂	21—21—17	170	87	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20343	♀	21—21—17	170	78	8—8	10—10	2—2	3—3	1—1	1+3——1+3	6
20344	♂	21—21—17	169	86	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20345	♂	21—21—17	170	85	8—8	10—10	2—2	3—3	1—1	1+2+4—1+2+3	6
20346	♂	21—21—17	171	94	8—8	10—10	1—1	3—3	1—1	1+3+3—1+2+3	6
20347	♀	21—21—17	165	80	8—8	10—10	2—2	3—4	1—1	1+2+4—1+2+3	6
20349	♂	21—21—17	171	93	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20350	♂	21—21—17	174	91	8—8	?—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20351	♀	21—21—17	167	58+	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20352	♂	21—21—17	168	89	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20353	♀	21—21—17	175	60+	8—8	10—10	1—1	4—3	1—1	1+2+3—1+2+3	6
20354	♂	21—21—17	174	91	8—8	10—10	2—2	3—3	1—1	1+3+3—1+2+3	6
20355	♀	21—21—17	171	80	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20356	♀	21—19—17	171	79	8—8	9—9	2—2	3—3	1—1	1+2+3—1+2+3	6
20357	♀	21—21—17	169	78	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20358	♀	21—21—17	165	79	8—8	10—10	2—2	3—3	1—1	1+3+3—1+3+3	6
20359	♀	21—21—17	165	76	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20360	♀	21—17	169	70	8—8	10—10	2—1	3—3	1—1	1+2+3—1+2+3	6
20361	♀	21—21—17	168	66	8—9	10—10	2—1	4—4	1—1	1+2+3—1+2+3	6
20362	♀	21—21—17	164	43+	8—8	10—10	2—2	3—4	1—1	1+2+3—1+2+3	6

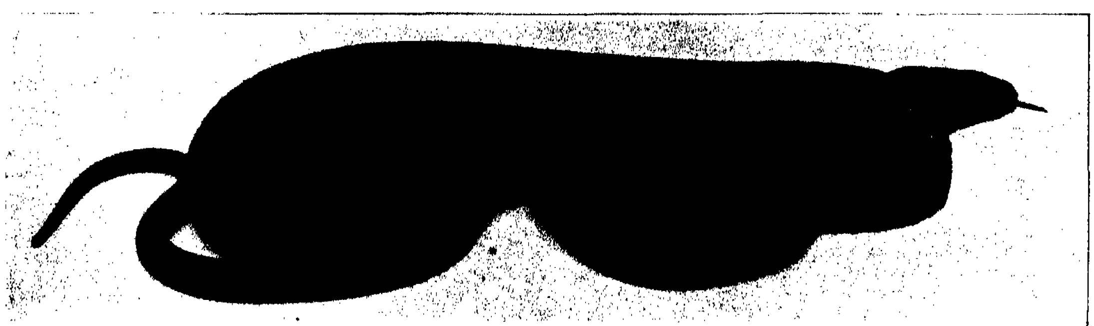
Scale counts in *Thamnophis ordinoides biscutatus* (Cope)—Continued

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Local-ity
20363	♀	21—21—17	168	74	8—8	9—10	2—2	3—4	1—1	1+2+3—1+2+3	6
20364	♀	21—21—17	168	82	8—8	10—10	2—1	3—3	1—1	1+3+3—1+3+3	6
20365	♂	21—21—17	169	57+	8—8	9—9	1—1	3—3	1—1	1+2+3—1+2+3	6
20366	♀	21—21—17	168	82	7—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20367	♂	21—21—17	173	88	8—8	10—9	2—2	3—3	1—1	1+2+3—1+2+3	6
20368	♀	21—21—17	168	82	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20369	♀	21—21—17	163	79	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20370	♂	21—21—17	177	92	8—8	10—10	1—2	3—3	1—1	1+2+3—1+2+3	6
20371	♀	21—21—17	168	79	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20372	♀	21—21—17	168	21+	8—8	10—10	1—1	3—3	1—1	1+2———1+3	6
20373	♀	21—21—17	164	75	8—9	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20374	♀	21—21—17	162	80	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20375	♂	21—21—17	171	93	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20376	♂	21—21—17	173	91	8—8	10—10	2—2	2—3	1—1	1+2+3—1+2+3	6
20377	juv.	21—17	161	79	7—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20378	"	23—17	161	84	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+2	6
20379	"	21	171	77	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20380	"	23	165	75	8—8	10—10	2—2	4—4	1—1	1+2+3—1+3	6
20381	"	21—17	172	93	8—8	10—10	2—2	3—3	1—1	1+2+2—1+2+2	6
20382	"	21	170	90	8—8	10—10	2—2	3—3	1—1	1+2+2—1+2+2	6
20383	"	21—21—17	166	77	8—8	10—10	2—1	4—3	1—1	1+2+3—1+2	6
20384	"	21—17	173	88	8—7	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20385	"	21—21—17	163	91	8—8	10—10	2—2	3—3	1—1	1+2+2—1+2+2	6
20386	♀	23	165	89	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	6
20387	♀	21—21—17	168	68+	7—8	10—9	1—1	3—3	1—1	1+2+3—1+2+3	6
20390	♂	21—21—17	170	90	8—8	10—11	1—1	3—3	1—1	1+3+3—1+2+4	6
20391	♀	21—21—17	167	81	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20392	♀	21—21—17	171	40+	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+4	6
20393	♀	21—21—17	170	68+	8—8	10—10	2—2	4—3	1—1	1+2+3—1+2+3	6
20394	♀	21—21—17	171	65+	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20395	♀	21—21—17	165	80	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
20396	♀	21—21—17	170	53+	8—8	10—11	1—1	3—3	1—1	1+2+3—1+3+3	6
20397	♀	21—21—17	168	60+	8—8	10—10	2—2	3—3	1—1	1+2+4—1+2+3	6
20398	♀	21—21—17	166	19+	8—8	10—10	2—2	4—3	1—1	1+2+3—1+2+3	6
20399	♀	21—21—17	165	76	8—8	10—10	2—2	4—3	1—1	1+3+4—1+3+4	6
20400	♀	21—19—17	162	73	8—7	10—10	1—1	3—3	1—1	1+2+3—1+2+3	6
S1782	♂	23—19—17	172	86+	8—8	10—10	2—2	3—3	1—1	1+2———1+2	6
S1783	♂	21—19—17	172	93c	8—8	10—10	2—2	3—3	1—1	1+2———1+2	6
S1785	♀	23—19—17	168	77c	8—8	10—10	1—1	3—3	1—1	1+2———1+3	6
S4134	♀	21—17—17	165	71+	8—8	10—10	2—2	3—3	1—1	1+3———1+3	6
C5431	♀	21—21—17	166	70	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	7
C5432	♀	21—21—17	165	69+	7—8	10—10	1—2	3—3	1—1	1+3———1+3	7
C2147	♂	21—21—17	177	85	8—8	10—10	2—2	3—3	1—1	1+2+2—1+2+2	8
C2149	♀	19—19—17	173	82	8—8	10—10	1—1	3—3	1—1	....	8
C2152	♂	20—21—17	179	83	8—8	10—10	2—2	3—3	1—1	1+2+3—1+2+3	8
C2153	♂	21—21—17	183	92	8—8	10—10	1—1	3—3	1—1	1+2+3—1+2+3	8
C2158	♂	21—21—17	175	91	8—8	9—10	2—2	3—3	1—1	1+3+3—1+2+3	8
C2163	♀	21—21—17	171	74	8—8	10—10	2—1	3—3	1—1	————1+2	9

Remarks.—These snakes from the Klamath region are very similar to *T. o. vagrans* but the ground color of the dorsolateral regions usually is much darker. For this reason the dark spots usually are inconspicuous. Occasional specimens show the spots very distinctly, and in most specimens they may be seen when looked for. These spots invade the dorsal line just as they do in typical *T. o. vagrans.* The chief point of distinction between *T. o. biscutatus* and *T. o. vagrans* is the increase in the number of preoculars. Less than twenty-five per cent of the Klamath specimens do not show this increase on at least one side of the head, so that it must be regarded as a per-



a.—*Thamnophis ordinoides couchii*, Giant Garter-Snake:—Photograph from living specimen collected at Gadwall, Merced County, California, May 12, 1918.



b.—*Thamnophis ordinoides couchii*, Giant Garter-Snake:—Photograph from living specimen collected at Gadwall, Merced County, California, May 12, 1918.

fectly good subspecific character. A small number of the specimens also show an increased number of body scale-rows.

Specimens from northwestern Nevada, as those from the Pine Forest Mountains, Virgin Valley, and Quinn River Crossing, in Humboldt County, appear to be intermediate between this form and true *T. o. vagrans,* the coloration being typical of the latter while a tendency toward an increase in the number of preoculars is still present. These are listed with *T. o. vagrans.*

In the region of Puget Sound snakes of the *vagrans* type, a majority of which have two preoculars, are again encountered. We can see no reason for not including them here. It seems best to include here also the snakes from Del Norte County, California, and from Josephine and Coos counties, Oregon, although the number of specimens from these localities is so small as to leave one in doubt as to the usual number of preoculars, and the coloration is more like that of *T. o. couchii.*

Perhaps nowhere else in the world are snakes so abundant as near Klamath Falls. We counted a hundred and eighty on a small rock about a yard in diameter in Link River, and, at another point on the same river, caught fourteen with one grab with both hands.[2] They feed upon small fish and toads. Most of these snakes are of this subspecies, but a few are *Thamnophis sirtalis infernalis.*

Thamnophis ordinoides couchii (Kennicott)

Giant Garter-Snake.

Diagnosis.—Normally with eight supralabials; twenty-one rows of scales; no red in coloration; dorsal line absent or indistinct posteriorly, usually distinct on neck; usually some dark markings on gastrosteges, preocular usually single; infralabials often more than ten.

Type Locality.—Pitt River, California.

[2] In June, 1918, some nine years later, they were not especially abundant here.

Synonyms.—No other names have been based upon individuals of this race. Specimens have been referred sometimes to *hammondii*, sometimes to *vagrans*, or *elegans*.

Range.—This subspecies is the common water-snake of the Sacramento and San Joaquin valleys of California from Shasta to Kern counties. It ranges west into Monterey County, where it has been taken in the valleys of the Carmel River and San Antonio and Nacimiento creeks. It ascends the valley of the Kern River to an altitude of some 6000 feet, and, doubtless, crosses through Walker Pass to the east side of the Sierra Nevada where it occurs in Owens Valley and about Pyramid Lake and Lake Tahoe. Its range lies chiefly in the Lower and Upper Sonoran zones.

We have examined specimens from the following localities:—

1. Carmel Valley, Monterey Co., California.
2. San Antonio Creek, near Mission San Antonio, Monterey Co., Cal.
3. Nacimiento Creek, Monterey Co., Cal.
4. Long's Ranch, Battle Creek, Shasta Co., Cal.
5. Cottonwood, Shasta Co., Cal.
6. Orland, Glenn Co., Cal.
7. Stoney Creek, Glenn Co., Cal.
8. Strawberry Valley, Yuba Co., Cal.
9. Red Point, Placer Co., Cal.
10. Fyffe, El Dorado Co., Cal.
11. Riverton, El Dorado Co., Cal.
12. Priest Hill, Tuolumne Co., Cal.
13. Pleasant Valley, Mariposa Co., Cal.
14. Yosemite Valley, Mariposa Co., Cal.
15. Los Baños, Merced Co., Cal.
16. Merced Co., Cal.
17. Gadwall, Merced Co., Cal.
18. Raymond, Madera Co., Cal., at 940 feet altitude.
19. Hume, Fresno Co., Cal.
20. Fresno, Fresno Co., Cal.
21. Trout Meadows, Tulare Co., Cal.
22. Little Kern River Lake, Tulare Co., Cal.
23. Trout Creek, 6000 feet, Sierra Nevada, Tulare Co., Cal.

24. Cannell Meadows, Sierra Nevada, Tulare Co., Cal.
25. Walkers Basin, Kern Co., Cal.
26. Kern River, near Bodfish, Kern Co., Cal., at 2400 feet.
27. Buena Vista Lake, Kern Co., Cal.
28. Mt. Tallac, El Dorado Co., Cal.
29. Fallen Leaf Lake, El Dorado Co., Cal.
30. Fallen Leaf Lake, El Dorado Co., Cal.
31. Tahoe City, Placer Co., Cal.
32. Lake Tahoe, El Dorado Co., (?) Cal.
33. Glenbrook, Douglas Co., Nevada.
34. Wadsworth, Washoe Co., Nev.
35. Pyramid Lake, Washoe Co., Nev.
36. Owens Valley, Inyo Co., Cal.
37. Laws, Inyo Co., Cal.

Material.—Sixty-seven specimens from these thirty-seven localities have been included in this study.

Variation.—Sixty-five specimens show the following variations:

Loreal 1—1 in all specimens. Preoculars 1—1 in fifty-two, or 81%; 2—2 in eleven, or 17%; and 1—2 in one, or 2%. Postoculars 3—3 in fifty-six, or 89%; 2—3 in six, or 9%; and 2—2 in one, or 2%. Temporals 1+2—1+2 in thirty-eight, or 60%; 1+3—1+3 in thirteen, or 20%; 1+2—1+3 in eleven, or 17%; and 1+3—1+4 in one, or 2%. The supralabials are 8—8 in sixty-two, or 95%; and 8—9 in three, or 5%. The infralabials are 10—10 in forty, or 61%; 11—11 in twelve, or 18%; 9—10 in six, or 9%; 10—11 in five, or 8%; 11—9 in one, or 2%; and 9—9 in one, or 2%. The scale-rows are 21—19—17 in thirty-one, or 48%; 21—21—17 in twenty-four, or 38%; 19—21—19—17 in six, or 9%; 19—19—17 in two, or 3%; and 23—21—17 in two, or 3%. The gastrosteges vary from 153 to 181, males having from 160 to 181, females from 153 to 177; the average in twenty-two males is 172.3, in forty-three females, 167. The urosteges vary from 65 to 99, males having from 77 to 99, females from 65 to 88; the average in fourteen males is 88.4, in thirty-eight females, 81.7.

This variation is shown in full in the following table of scale-counts.

Scale counts in *Thamnophis ordinoides couchii*

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Local-ity
S4273	♀	21—21—19—17	164	68c	8—9	10—10	2—2	3—3	1—1	1+2——1+2	1
S4326	♀	21—21—17—17	165	73c	8—8	10—10	2—2	3—3	1—1	1+3——1+3	1
S6513	♀	21—21—19—17	166	73+	8—8	10—10	2—2	3—3	1—1	1+3——1+2	2
S6518	♀	21—21—19—17	162	68c	8—8	10—10	2—2	3—3	1—1	1+2——1+2	3
S6519	♀	21—21—19—17	156	71c	8—8	10—10	1—2	3—3	1—1	1+2——1+2	3
S6708	♀	21—21—19—17	171	75c	8—8	11—11	1—1	3—3	1—1	1+2——1+3	4
S4432	♀	19—19—17—17	160	81c	8—8	10—10	1—1	2—2	1—1	1+3——1+2	5
S4433	♂	19—21—19—17	170	84c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	5
S4431	♂	19—19—17—17	162	83c	8—8	10—10	1—1	3—3	1—1	1+3——1+3	6
S4430	♂	19—21—19—17	167	75+	8—8	10—10	1—1	3—3	1—1	1+2——1+2	7
S6309	♂	21—21—19—17	177	89c	8—8	11—11	1—1	3—3	1—1	1+3——1+3	8
S1805	♀	21—21—17—17	169	79c	8—8	11—11	1—1	3—3	1—1	1+2——1+3	9
S4169	♀	21—21—17—17	175	77c	8—8	10—10	1—1	2—3	1—1	1+2——1+2	10
S4376	♀	21—21—19—17	163	83c	8—8	11—11	1—1	3—3	1—1	1+2——1+2	11
S4377	♀	21—21—17—17	168	....	8—8	10—10	1—1	3—3	1—1	1+3——1+3	11
39636	♂	21—21—19—17	179	99c	8—8	9—10	1—1	3—3	1—1	1+3——1+3	11
S4132	♀	21—21—19—17	167	82c	8—8	10—10	1—1	3—3	1—1	1+3——1+3	12
C5893	♂	21—21—19—17	170	68+	8—8	10—10	1—1	3—3	1—1	1+2——1+2	13
C5898	♀	21—21—19—17	163	80c	8—8	10—10	1—1	3—2	1—1	1+2——1+2	13
C5899	♀	21—21—19—17	167	72+	8—8	11—11	1—1	3—3	1—1	1+2——1+3	13
C5897	♂	21—21—19—17	176	37+	8—8	10—10	1—1	3—3	1—1	1+2——1+2	14
C5904	♀	21—21—19—17	174	85c	8—8	10—10	1—1	3—3	1—1	1+2——1+3	14
C5902	♂	21—21—19—17	181	97c	8—8	9—10	1—1	3—3	1—1	1+2——1+2	14
13635	♀	21—21—17	155	71c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	15
13636	♂	21—21—17	160	77c	8—8	X—9	2—2	3—3	1—1	1+2——1+2	15
13637	♀	23—21—17	159	68c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	15
13638	♀	21—21—17	159	70c	8—8	11—10	1—1	3—3	1—1	1+2——1+2	15
17999	♀	21—21—17	157	41+	8—8	9—10	1—1	3—3	1—1	1+2——1+2	15
36071	♀	21—21—17	157	65c	8—8	11—9	1—1	3—3	1—1	1+2——1+2	15
13640	♀	21—21—17	156	71c	8—8	11—11	1—1	3—3	1—1	1+2——1+3	16
C5428	♀	21—21—17	159	68c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	17
C2753	♀	21—21—17	166	81c	8—8	11—11	2—2	3—3	1—1	1+3——1+3	18
C6265	♀	21—21—19—17	176	88c	8—8	10—10	2—2	3—3	1—1	1+3——1+2	19
S1753	♀	21—21—17	169	82c	8—8	10—10	1—1	3—3	1—1	1+3——1+2	20
S1754	♀	21—21—17	169	81c	8—8	10—10	2—2	3—3	1—1	1+2——1+2	20
S1756	♀	21—21—17	170	59+	8—8	10—10	2—1	3—3	1—1	1+2——1+2	20
S4127	♂	21—21—17	172	94c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	20
S1755	♀	21—19—17	168	78c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	20
S1665	♀	21—21—17	169	80c	8—8	10—10	1—1	3—3	1—1	1+3——1—	21
S1666	♀	21—21—17	174	85c	8—8	11—11	1—1	3—3	1—1	1+2——1+2	22
C2808	♂	21—21—17	175	51+	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	23
C2809	♀	21—21—17	166	84c	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	23
C2806	♂	19—21—17	170	88c	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+2	24
C2807	♀	21—21—17	165	84c	8—8	10—10	1—1	3—3	1—1	1+2+2—1+2+1	24
C2800	♀	21—21—17	173	82c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	25
C2799	♂	21—21—17	172	31+	8—8	11—11	1—1	3—3	1—1	1+2+2—1+2+2	26
43256	♀	21—21—19—17	155	75c	8—8	11—11	1—1	3—3	1—1	1+2——1+2	27
43257	♂	21—21—19—17	162	78c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	27
43258	♀	21—21—19—17	158	69c	8—8	11—10	1—2	3—2	1—1	1+2——1+2	27
43259	♀	23—21—19—17	153	72c	8—8	10—11	1—1	3—3	1—1	1+2——1+2	27
43260	♂	21—21—19—17	167	83c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	27
S6675	♀	21—21—17	170	85c	8—8	11—10	2—2	3—3	1—1	1+2——1+2	28
S5313	♀	21—21—19—17	167	80c	8—8	10—10	2—2	3—3	1—1	1+3——1+3	29
36320	♂	21—21—17	179	98c	8—8	10—9	2—2	2—3	1—1	1+3——1+3	29
36321	♂	19—21—17	174	79c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	29
36322	♀	21—21—17	162	84c	8—8	9—9	1—1	3—3	1—1	1+3——1+2	29
36324	♀	19—21—17	166	78c	8—8	10—10	1—1	3—3	1—1	1+2——1+2	29
S6560	♀	21—21—19—17	176	44+	8—8	11—11	1—1	3—3	1—1	1+3——1+2	31
S6561	♀	19—21—19—17	170	77+	8—9	10—10	1—1	3—2	1—1	1+3——1+4	31
S1695	♂	21—21—19—17	177	92c	8—8	11—10	1—1	3—3	1—1	1+2——1+2	31
S6532	♀	21—21—19—17	166	77c	8—9	10—10	1—1	2—3	1—1	1+3——1+3	32
37999	♀	21—21—19—17	171	88c	8—8	10—10	2—2	3—3	1—1	1+3——1+3	33
S6563	♂	21—21—21—17	176	96c	8—8	10—10	2—2	3—3	1—1	1+3——1+2	34
S6564	♀	21—21—21—17	177	78c	8—8	10—10	2—2	3—3	1—1	1+3——1+3	35
C6684	♀	21—21—19—17	170	....	8—8	10—10	1—2	3—3	1—1	1+2——1+2	36
C6685	♀	21—19—17—17	169	83c	8—8	10—11	1—1	2—2	1—1	1+2——1+2	37

Remarks.—Garter-snakes from the San Joaquin Valley and Lower Sierra Nevada have been referred usually to *T. vagrans* or *T. hammondii.* This has never been satisfactory, for, although the San Joaquin snakes resemble both these subspecies, they are not like typical specimens of either, but rather may be said to combine characters of both. Certain specimens resemble *T. o. hammondii* rather closely, but the presence of a dorsal line on at least a portion of the neck will usually serve to distinguish them from that form. Sometimes the line is continued along the back, but it often is very indistinct. The gastrosteges seem to be somewhat more numerous than in *T. o. hammondii,* and a similar tendency is apparent in the infralabials, which often are eleven instead of ten. On the other hand, two preoculars are found much less frequently than in *T. o. hammondii.* Intergradation between these two subspecies is shown by certain specimens from the San Joaquin Valley, but seems to be individual rather than geographic. It doubtless will become more evidently geographic when specimens are secured from the proper areas.

The relationship of *T. o. couchii* to *T. o. vagrans* is still closer than to *T. o. hammondii.* This is shown by the character of the spotting adjacent to the dorsal line when present, the frequent occurrence of more or less dark pigment on the gastrosteges, and the fact that in many of the specimens of *T. o. couchii* some indication of a dorsal line is present.

In typical *T. o. vagrans,* as it occurs in Idaho, Utah and eastern Nevada, the dorsal line is well marked, the dorsal spots are very evident and invade the edges of the dorsal line, and the gastrosteges almost always are rather heavily pigmented. *T. o. couchii* differs from this type of coloration in the shortness or indistinctness of its dorsal line, which may be only a half-inch in length, in the less frequent and less extensive pigmentation of the gastrosteges, and in the absence, indefiniteness, or less characteristic arrangement of the dorsal spots. Intergradation between *T. o. couchii* and *T. o. vagrans* is to be looked for in western Nevada.

The relationship between *T. o. couchii* and *T. o. elegans* also is very close. Typical *T. o. elegans* seems to occur only at considerable elevations in the Sierra Nevada and in the mountains of southern California. *T. o. couchii* occupies the lower

levels, but extends its range up in the Sierra Nevada so far, at certain points, that it overlaps that of *T. o. elegans,* just as the range of *T. o. hammondii* overlaps that of *T. o. elegans* in the San Bernardino Mountains of southern California. But, while *T. o. hammondii* and *T. o. elegans* seem to remain perfectly distinct and true to character at the places where their ranges meet, specimens showing intermediate characters are found at the points where *T. o. couchii* and *T. o. elegans* come in contact, as at Jackass Meadows, 7,750 feet, Tulare County, and in the Yosemite Valley. At other places, as at Fallen Leaf Lake, El Dorado County, and at Glenbrook, Nevada, snakes of both types have been taken but no intermediate specimens have been secured.

One specimen had eaten a young blackbird. Another had caught a six-inch trout.

Where conditions are favorable these snakes often attain enormous size. No. 43256 measures fifty-five and a half inches, of which twelve and a quarter inches represent the tail. No. 43259 has the same measurement to anus, but the tail is one and a quarter inches shorter. These snakes were secured at Buena Vista Lake, where they live in patches of tules out in the lake and doubtless eat fish. Although they may be seen in considerable numbers sunning themselves on the broken-down tules, they are hard to shoot, for they are very shy and slide into the water at the least alarm. Several were seen which appeared to be larger than any secured by us. The largest specimens sometimes show no lateral lines or other markings. Specimens of similar size occur in the marshes near Los Baños.

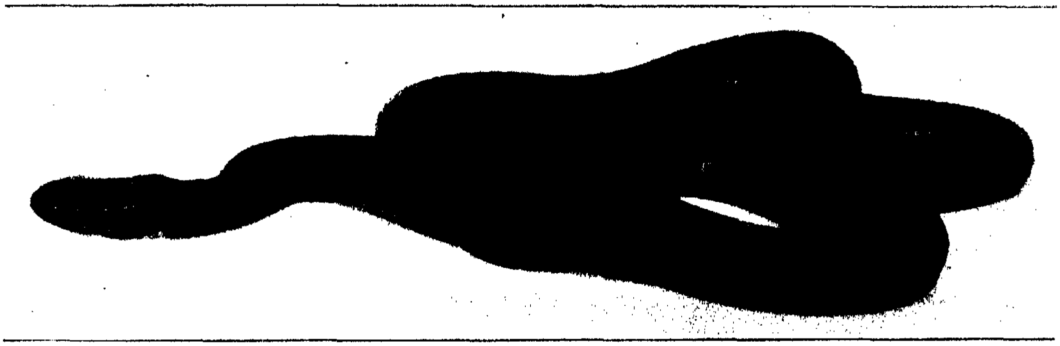
Thamnophis ordinoides hammondii (Kennicott)

California Garter-Snake.

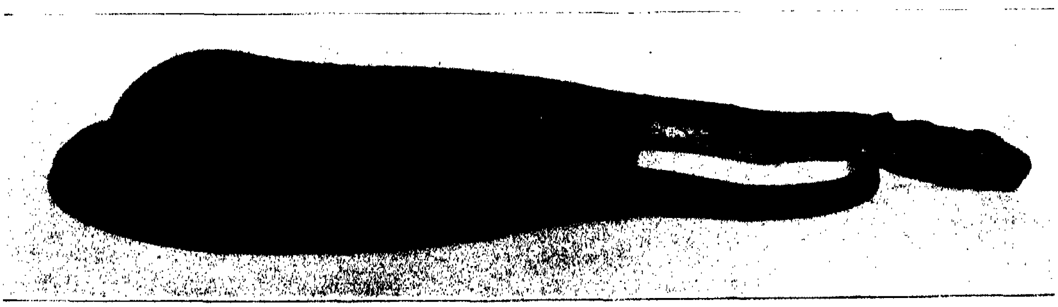
Diagnosis.—Normally with eight supralabials; twenty-one rows of scales; no red in coloration; no dorsal line; no black on gastrosteges; often with two preoculars; infralabials rarely more than ten.

Type Locality.—San Diego and Fort Tejon, California.

Synonyms.—The only other name which has been based upon individuals of this race seems to be *Tropidonotus digueti*



a.—*Thamnophis ordinoides hammondii*, California Garter-Snake:—Photograph from living specimen collected at Los Angeles, California, May 13, 1915.



b.—*Thamnophis ordinoides hammondii*, California Garter-Snake:—Photograph of living young specimen collected at Los Angeles, May 13, 1915.

Mocquard, 1899; type localities Mulege and San Ignacio, Lower California, Mexico.

Range.—This subspecies is the common water-snake of southern California west of the deserts. Where streams run from the western mountains down onto the desert this snake may follow them for some distance, as, to Victorville on the Mohave River, and Palm Canyon at the eastern base of the San Jacinto Mountains. It ranges at least from sea level to an altitude of 8000 feet. The most northern locality from which we have seen a typical specimen is Oceano, San Luis Obispo County. It occurs also in Santa Barbara, Ventura, Los Angeles, San Bernardino, Riverside and San Diego counties, and northwestern Lower California. Its range is chiefly in the Upper Sonoran Zone but extends into the Lower Sonoran and Transition zones.

We have examined specimens from the following localities:—

1. Oceano, San Luis Obispo Co., California.
2. Santa Inez River, Santa Barbara Co., Cal.
3. Santa Paula, Ventura Co., Cal.
4. West Fork of San Gabriel River, Los Angeles Co., Cal.
5. Pasadena, Los Angeles Co., Cal.
6. Los Angeles, Los Angeles Co., Cal.
7. Rock Creek, Los Angeles Co., Cal.
8. San Bernardino Co., Cal.
9. Victorville, San Bernardino Co., Cal.
10. Santa Ana Canyon, San Bernardino Co., Cal.
11. Santa Ana River, San Bernardino Mountains, San Bernardino Co., Cal.
12. San Bernardino Mountains, San Bernardino Co., Cal.
13. Ontario, San Bernardino Co., Cal.
14. Chino, San Bernardino Co., Cal.
15. Riverside, Riverside Co., Cal.
16. San Jacinto Valley, Riverside Co., Cal.
17. Keen Camp, Riverside Co., Cal.
18. Hemet Lake, Riverside Co., Cal.
19. Base of San Jacinto Mountains, near Cabazon, Riverside Co., Cal.

20. Mouth of Palm Canyon, San Jacinto Mountains, Riverside Co., Cal.
21. Tahquitz Valley, 8000 feet, San Jacinto Mountains, Riverside Co., Cal.
22. San Diego Co., Cal.
23. Agua Caliente, San Diego Co., Cal.
24. Oak Grove, San Diego Co., Cal.
25. Near Carlsbad, San Diego Co., Cal.
26. Santa Isabel Valley, San Diego Co., Cal.
27. Witch Creek, San Diego Co., Cal.
28. Cuyamaca Mountains, San Diego Co., Cal.
29. Sweet Water Dam, San Diego Co., Cal.
30. Dulzura, San Diego Co., Cal.
31. Campo, San Diego Co., Cal.

Material.—Seventy-five specimens from these thirty-one localities in California have been included in this study.

Variation.—These specimens show the following variations:

Loreal 1—1 in all specimens. Preoculars 2—2 in thirty-one, or 42%; 1—1 in twenty-seven, or 36%; 2—1 in thirteen, or 18%; 3—3 in two, or 3%; and 2—3 in one, or 1%. Postoculars 3—3 in sixty-six, or 92%; 3—4 in three, or 4%; 4—4 in two, or 3%; and 3—2 in one, or 1%. Temporals 1+2—1+2 in forty-two, or 56%; 1+2—1+3 in twenty-one, or 28%; 1+3—1+3 in twelve, or 16%. The supralabials are 8—8 in all except one specimen which has 8—9. The infralabials are 10—10 in sixty-nine, or 92%; 10—9 in three, or 4%; 9—9 in two, or 3%; and 10—11 in one, or 1%. The scale-rows are 21—21—17 in sixty-two, or 83%; 21—19—17 in eleven, or 15%; 19—21—17 in one, or 1%; and 19—19—17 in one, or 1%. The gastrosteges vary from 156 to 173, males having from 163 to 173, females from 156 to 171; the average in thirty-seven males is 168.1, in thirty-four females, 162.6. The urosteges vary from 67 to 88, males having from 69 to 88, females from 67 to 82; the average in twenty-five males is 81.2, in twenty-one females, 73.1.

This variation is shown in full in the following table of scale-counts.

Scale counts in *Thamnophis ordinoides hammondii*

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Local-ity
43368	♀	19—21—19—17	160	58+	8—8	10—10	1—2	3—3	1—1	1+2—1+3	1
C4319	♀	19—19—17	170	80	8—8	10—10	1—1	3—3	1—1	1+2—1+2	2
S4190	♀	21—21—17	164	75c	8—8	10—10	2—2	3—3	1—1	1+2—1+2	3
C4318	♂	21—21—17	169	83	8—8	10—10	2—2	3—3	1—1	1+2—1+2	4
27812	♂	21—21—17	168	82c	8—8	9—10	2—2	4—4	1—1	1+2—1+2	4
C757	♀	21—21—17	168	76	8—8	10—10	2—2	3—3	1—1	1+3—1+3	5
40031	♀	21—21—19—17	160	39+	8—8	10—10	2—2	3—3	1—1	1+2—1+3	6
40032	♀	21—21—19—17	167	70c	8—8	10—10	1—1	3—3	1—1	1+3—1+3	6
S5645	♂	21—21—17	164	88c	8—8	10—10	1—1	3—3	1—1	1+3—1+3	7
S4395	♀	21—21—17	169	72c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	8
S4396	♂	21—21—17	169	45+	8—8	9—9	1—1	3—3	1—1	1+2—1+2	8
S4397	♀	21—21—17	163	67c	8—8	10—10	2—2	3—2	1—1	1+2—1+3	8
S4398	♀	21—21—17	161	72+	8—8	10—10	2—1	3—3	1—1	1+2—1+2	8
S4399	♂	21—21—17	169	33+	8—8	10—10	2—2	3—3	1—1	1+2—1+2	8
S4400	♂	21—21—17	172	80c	8—8	10—10	1—1	2—2	1—1	1+2—1+2	8
S4401	♂	21—21—17	170	61+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	8
S4402	♀	21—21—17	156	78c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	8
S4403	♂	21—21—17	169	81c	8—8	10—10	1—1	3—3	1—1	1+3—1+2	8
S6307	♂	21—21—17	171	78c	8—8	10—10	2—2	3—3	1—1	1+2—1+2	8
C766	♂	21—21—17	178	80	8—8	10—10	2—2	3—4	1—1	1+3—1+3	9
C5388	♂	21—21—17	164	83	8—8	10—10	1—1	3—3	1—1	1+2—1+3	9
42850	♀	21—19—17	171	X	8—8	10—10	1—2	3—3	1—1	1+3—1+3	9
S5165	♂	21—21—17	169	38+	8—8	10—10	2—1	3—3	1—1	1+2—1+2	10
C742	♀	21—21—17	159	59+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	11
C640	♂	21—21—17	168	85	8—8	10—10	2—2	3—3	1—1	1+2—1+2	11
C709	♂	21—21—17	170	85	8—8	10—10	2—2	3—3	1—1	1+2—1+2	11
S4390	♂	21—21—17	168	76+	8—8	10—10	2—2	3—3	1—1	1+2—1+2	12
S4391	♂	21—21—17	166	60+	8—8	10—10	2—1	3—3	1—1	1+2—1+2	12
S4392	♀	21—21—17	162	39+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	12
S4393	♂	21—21—17	170	82c	8—8	10—10	1—2	4—3	1—1	1+2—1+2	12
S4394	♂	21—21—17	166	49+	8—8	10—10	1—1	3—3	1—1	1+2—1+3	12
S5241	♂	21—21—17	164	50+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	12
S4315	♀	21—21—17	160	62+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	13
S4316	♀	21—21—17	158	72c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	13
S4317	♀	21—21—17	161	71+	8—8	10—10	2—2	4—4	1—1	1+3—1+2	13
S4318	♀	21—21—17	161	72c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	13
S4324	♂	21—21—17	167	87c	8—8	10—10	2—2	3—3	1—1	1+2—1+2	14
S5516	♂	21—X—17	173	84c	8—8	10—10	2—2	3—3	1—1	1+2—1+2	15
S6306	♂	21—21—17	170	82+	8—8	10—10	2—2	3—3	1—1	1+3—1+3	15
S1141	♂	21—21—17	167	72+	8—8	10—10	1—1	3—3	1—1	1+3—1+3	16
S1142	♀	21—21—17	160	67c	8—8	10—10	2—1	3—3	1—1	1+3—1+2	16
S1176	♂	21—21—17	165	83c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	16
S1178	♂	21—21—17	168	82c	8—8	10—10	2—2	3—3	1—1	1+2—1+2	16
S1179	♂	21—21—17	164	66+	8—8	9—9	1—2	3—3	1—1	1+2—1+2	16
S1180	♂	21—20—19—17	165	82c	8—8	10—10	2—2	3—3	1—1	1+2—1+2	16
S1181	♂	21—21—17	172	78c	8—8	10—10	1—2	3—3	1—1	1+3—1+3	16
S1182	♀	21—21—17	162	72c	8—8	10—10	1—1	3—3	1—1	1+3—1+2	16
S1211	♂	21—21—17	167	78c	8—8	10—10	2—2	3—3	1—1	1+3—1+3	16
S4321	♂	21—21—17	172	83c	8—8	10—10	2—2	3—3	1—1	1+2—1+2	16
42876	♀	21—21—19—17	160	54+	8—9	10—11	1—2	3—3	1—1	1+3—1+2	17
43100	♀	21—21—19—17	165	41+	8—8	10—10	2—2	3—3	1—1	1+2—1+3	18
C138	♂	21—21—17	163	88	8—8	10—10	2—2	3—3	1—1	1+2—1+3	19
C226	♂	21—21—17	171	50+	8—8	10—10	3—3	3—3	1—1	1+2—1+3	19
C244	♀	21—21—17	165	73	8—8	10—10	2—2	3—3	1—1	1+2—1+2	20
C555	♂	21—21—17	168	83	8—8	10—10	....	....	1—1	1+2—1+2	21
S1143	♀	21—21—17	159	69c	8—8	10—10	2—2	3—3	1—1	1+3—1+3	22
S1144	♀	21—21—17	162	73c	8—8	10—10	1—1	3—3	1—1	1+2—1+2	23
S1212	♀	21—21—17	164	73c	8—8	10—10	1—1	3—3	1—1	1+3—1+2	23
S1183	♂	21—21—17	173	75c	8—8	10—9	1—1	3—3	1—1	1+2—1+2	24
S1185	♀	21—21—17	164	82c	8—8	10—10	2—1	3—3	1—1	1+2—1+3	24
S1186	♀	21—21—17	161	73c	8—8	10—10	2—2	3—3	1—1	1+3—1+2	24
S5598	♀	21—21—17	158	62+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	24
S5599	♂	21—21—17	169	86c	8—8	10—10	2—2	3—3	1—1	1+3—1+3	24
S1184	♂	21—21—17	172	83+	8—8	9—10	3—3	3—3	1—1	1+2—1+2	25
S1187	♂	21—21—17	166	80c	8—8	10—10	1—2	3—3	1—1	1+2—1+2	26
C625	♀	21—21—17	163	74	8—8	10—10	1—1	3—4	1—1	1+2—1+2	27
C624	♀	21—21—17	162	58+	8—8	10—10	2—2	3—3	1—1	1+2—1+2	28
13632	♂	21—21—17	167	69+	8—8	10—10	2—3	3—3	1—1	1+2—1+2	29
C1002	♂	21—21—17	170	59+	8—8	10—10	2—2	3—3	1—1	1+2—1+3	30
C1007	♀	21—21—17	162	71	8—8	10—10	2—1	3—3	1—1	1+3—1+2	30
40105	♀	21—21—19—17	164	43+	8—8	10—10	1—1	3—3	1—1	1+3—1+3	31
40106	♀	21—21—19—17	160	73c	8—8	10—10	2—2	3—3	1—1	1+3—1+2	31
40107	♀	21—21—19—17	164	74c	8—8	10—10	2—2	3—3	1—1	1+3—1+2	31
40108	♂	21—21—19—17	169	65+	8—8	10—10	2—2	3—3	1—1	1+3—1+2	31
40109	♀	21—21—19—17	168	39+	8—8	10—10	1—1	3—3	1—1	1+2—1+2	31

Remarks.—*Thamnophis ordinoides hammondii* is a well differentiated subspecies. The dorsal line is completely lacking in all specimens we have examined—even the youngest ones—which had been taken in southern California. Some specimens show a nuchal spot, but none even a short line. Specimens from this area also show little or no black on the belly. The name *hammondii* often has been applied to snakes collected farther north, as in the San Joaquin Valley, and the Sierra Nevada. These northern snakes, however, almost invariably have at least some trace of a dorsal line, and often show more or less black on the belly scutes, as in *vagrans*. Their status is discussed in this paper under the name *T. ordinoides couchii*. *T. o. hammondii* often (62%) has two preoculars on at least one side of the head, while *T. o. couchii* shows no such tendency. *T. o. hammondii*, however, shows no tendency toward an increase in the number of infralabials, while *T. o. couchii* does.

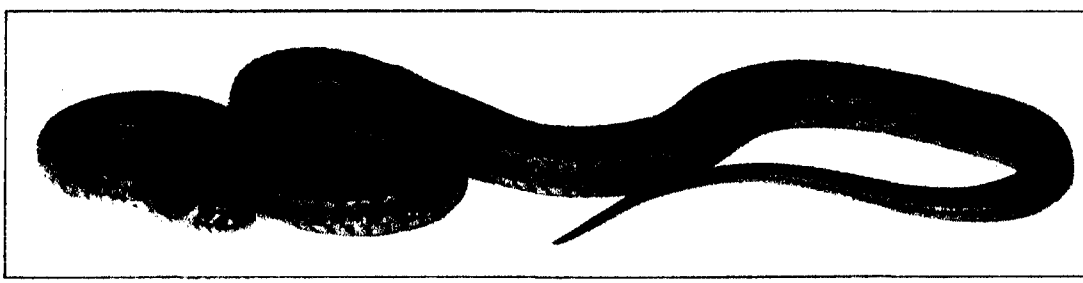
The specimens from San Luis Obispo, Santa Barbara and Ventura counties are perfectly typical *hammondii*. The localities where intergradation with *couchii* occurs cannot yet be defined. They are, doubtless, in southern Kern County. Individual variation, in a very few specimens from the San Joaquin Valley, almost bridges the space between the characters of typical *couchii* and *hammondii*.

In the San Bernardino Mountains *T. o. hammondii* occurs with *T. o. elegans* at altitudes of 5000 to 7000 feet. Here the two forms seem to remain true to type, for no intermediate specimens have been taken. *T. o. elegans* seems to be a mountain form while *T. o. hammondii* occupies the lower country as well as higher elevations.

The snakes which formerly were recorded as *T. hammondii* from San Pedro Martir Mountains, on reëxamination, prove to be typical *T. o. vagrans*. *T. o. hammondii* has been recorded by others from San Antonio and La Guilla, Lower California.

So far as known the ranges of *T. o. hammondii* and *T. marcianus* do not meet.

This snake feeds on tadpoles, frogs and fish.



Thamnophis marcianus, Marcy's Garter-Snake:—Photograph from living specimen (No. 35159) collected at Fairbanks, Cochise County, Arizona, in August, 1912.

Thamnophis marcianus (Baird & Girard)

Marcy's Garter-Snake.

Diagnosis.—Normally with eight supralabials; twenty-one (or more) rows of scales; dorsal line distinct; lateral line anteriorly on scales of third row only; large, distinct dorsal dark spots and dark nuchal blotches; light postoral crescents; preocular single; infralabials often eleven.

Type Locality.—Red River, Arkansas=Cache Creek, Oklahoma, according to Ruthven.

Synonyms.—*Eutænia nigrolateris* Brown, 1889; type locality, Tucson, Arizona.

Range.—This garter-snake seems to occupy territory near the United States and Mexican border from the Gulf of Mexico to the Colorado River, extending its range north through Texas to Oklahoma. The details of its distribution through this area are yet to be worked out. As regards Arizona, authentic specimens have been recorded from the vicinity of Tucson and Yuma. At Yuma it occurs on both banks of the Colorado River, and the westernmost limits of its known range are along the banks of this river from Yuma north to Riverside Mountain in Riverside County.

We have examined specimens of *Thamnophis marcianus* from the following localities:—

1. Riverside Mountain, Colorado River, Riverside Co., California.
2. Colorado River, 8 miles east from Picacho, Imperial Co., Cal.
3. Fairbanks, Cochise Co., Arizona.
4. Tucson, Pima Co., Ariz.
5. Yuma, Yuma Co., Ariz.

Material.—Eight specimens from the above localities in California and Arizona have been studied by us. They, of course, are too few to show the limits of variation. Some data given by Ruthven are added to our own.

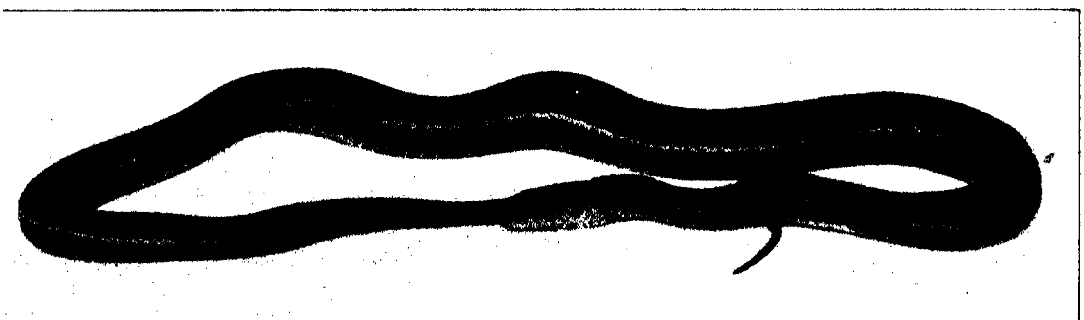
Variation.—The loreal is 1—1 in all our specimens. The preoculars are 1—1 in all. The postoculars are 3—3 in two, 3—4 in two, and 4—4 in two. The temporals are 1+3—1+3 in four, 1+2—1+2 in three, and 1+3—2+3 in one. The supralabials are 8—8 in twelve, 7—8 in one. The infralabials are 10—11 in four, and 10—10 in two. The scale-rows are 21—19—17 in ten, 21—21—17 in one, 23—23—17 in one, and 21—26 in one. The gastrosteges vary in number from 149 to 162, males having from 157 to 162, females from 149 to 159; the average in six males is 160.5, in eight females, 154.9. The urosteges vary from 63 to 79, males having from 77 to 79, females from 63 to 67; the average in two males is 78, in four females, 64.7. These variations are shown in full in the following table of scale-counts.

Scale counts in *Thamnophis marcianus*

Number	Sex	Scale rows	Gastrosteges	Urosteges	Supralabials	Infralabials	Preoculars	Postoculars	Loreals	Temporals	Locality
C1821	♂	21—21—17	162	79c	8—8	10—11	1—1	3—3	1—1	1+2—1+2	1
C1828	♀	23—23—17	155	63c	8—8	10—10	1—1	4—4	1—1	1+3—1+3	2
35159	♀	21—19—17	157	67c	8—8	10—11	1—1	3—3	1—1	1+3—1+3	3
35298	♀	21—19—17	149	64c	8—8	10—10	1—1	3—4	1—1	1+3—2+3	4
35299	♂	21—19—17	162	77c	8—8	10—11	1—1	3—4	1—1	1+2—1+2	4
35300	♀	21—19—17	156	65c	8—8	10—11	1—1	4—4	1—1	1+3—1+3	4
S——	..	21—19—17	159	65c	8—8	....	....	....	....	1+3—1+3	5
S——	..	21—26	159	54+	7—8	....	....	....	....	1+2—1+2	5
Ruthven	♂	21—19—17	160	....	8—8	....	....	....	....	....	4
Ruthven	♂	21—19—17	160	....	8—8	....	....	....	....	....	4
Ruthven	♀	21—19—17	156	....	8—8	....	....	....	....	....	4
Ruthven	♀	21—19—17	159	....	8—8	....	....	....	....	....	4
Ruthven	♀	21—19—17	...	....	8—8	....	....	....	....	....	4
Ruthven	♂	....	157	....	....	....	....	....	....	....	5
Ruthven	♂	....	162	....	....	....	....	....	....	....	5
Ruthven	♀	....	151	....	....	....	....	....	....	....	5
Ruthven	♀	....	156	....	....	....	....	....	....	....	5

Remarks.—Marcy's Garter-snake may usually be distinguished at a glance by its postoral crescents and the position of its lateral line. The dorsal spots of certain specimens resemble those of certain specimens of *T. o. vagrans,* but usually are larger. The gastrosteges ordinarily lack the dark markings which are so constant in *T. o. vagrans,* but frequently are marked with black laterally. The posterior genials usually are longer than the anterior.

Our specimens from Tucson were caught in mud puddles on the desert a mile or more from the river.



Thamnophis megalops, Mexican Garter-Snake:—Photograph from living specimen (No. 35161) collected at Fairbanks, Cochise County, Arizona, in August, 1912.

Thamnophis megalops (Kennicott)

Mexican Garter-Snake.

Diagnosis.—Normally with eight supralabials; twenty-one (or more) rows of scales; dorsal line distinct; lateral line involving scales of the third and fourth rows; no light postoral crescents; preocular single; infralabials ten.

Type Locality.—Tucson and Santa Magdalena, Arizona.

Synonyms.—It appears that no other names have been based upon specimens of this species taken in the United States. Mexican specimens have served as the types of *Eutænia macrostemma* Kennicott, 1860; type locality, City of Mexico; *Eutænia flavilabris* Cope, 1866; type locality, tableland or Southern Mountains of Mexico; and *Eutænia insigniarum* Cope, 1885; type locality, Chapultepec, Mexico.

Range.—The range of this snake apparently extends over most of the Mexican plateau region and north into southern Arizona and New Mexico. In Arizona, authentic specimens have been taken near Tucson and Fairbank. The species has been recorded also from Yuma, and Fort Whipple, but these records need confirmation.

We have examined specimens of *Thamnophis megalops* from the following localities:—

1. Tucson, Pima Co., Arizona.
2. Fairbanks, Cochise Co., Ariz.

Material.—Only six specimens from these localities are available.

Variation.—The loreal is 1—1 in all. The preoculars are 1—1 in all. The postoculars are 3—4 in three, 3—3 in two, and 4—4 in one. The temporals are 1+2—1+2 in three, 1+3—1+3 in two, and 1+2—1+3 in one. The supralabials are 8—8 in four and 8—9 in two. The infralabials are 10—10 in all six. The scale-rows are 21—19—17 in five, 21—23—21—19 in one. The gastrosteges vary in number from 154 to 162; the average in five females is 158.8. The urosteges vary from 72 to 77; the average in four females is 74.5.

Scale counts in *Thamnophis megalops*

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Local-ity
33876	♀	21—19—17	162	75c	8—8	10—10	1—1	3—4	1—1	1+3—1+3	1
33877	♀	21—19—17	154	38+	8—9	10—10	1—1	3—4	1—1	1+2—1+3	1
33878	♀	21—19—17	157	74c	8—8	10—10	1—1	3—3	1—1	1+3—1+3	1
35158	♀	21—23—21—19	159	77c	8—8	10—10	1—1	3—4	1—1	1+2—1+2	2
35160	?	21—19—17	161	....	8—8	10—10	1—1	3—3	1—1	1+2—1+2	2
35161	♀	21—19—17	162	72c	8—9	10—10	1—1	4—4	1—1	1+2—1+2	2
Ruthven	..	21—19—17	...	....	8—8	10—10	....	....	....	....	1
Ruthven	..	21—19—17	...	....	....	10—10	....	....	....	....	1
Ruthven	..	21—19—17	...	....	....	10—10	....	....	....	....	1
Ruthven	..	21—19—17	...	....	....	10—10	....	....	....	....	1
Ruthven	..	21—19—17	...	....	....	10—10	....	....	....	....	1
Ruthven	..	21—19—17	...	....	....	10—10	....	....	....	....	1
Ruthven	..	21—19—17	...	....	....	10—10	....	....	....	....	1
Ruthven	..	21—19—17	...	....	....	10—10	....	....	....	....	1

Remarks.—Our specimens from Tucson were caught close to the Santa Cruz River. No. 33876 was caught at about 4 P. M. in a pool near a ditch. It was swimming several inches below the surface of the water, seemingly in pursuit of small fish which were very numerous in the pool. The snake soon coiled up under some brush at the edge of the pool, and there we captured it. On the morning of March 30, 1912, we were walking along the banks of the Santa Cruz River hunting frogs when we heard a cry similar to that of a young kitten. As we drew nearer indistinct though loud croaking sounds could be heard at intervals interspersed with the kitten-like cries. Soon we discovered a garter-snake (No. 33877) of this species coiled up on shore a couple of feet from the edge of the water holding in its jaws a *Rana pipiens* which it had seized by one hind leg and which was crying lustily. When we approached still closer, the snake dropped the frog and both made for the water, which the frog succeeded in reaching.

Thamnophis angustirostris (Kennicott)

Brown-spotted Garter-Snake.

Diagnosis.—Normally with eight supralabials; scales in twenty-one rows; dorsal line absent; dorsal spots numerous, prominent; lateral lines showing faintly on second and third rows of scales, or absent; no postoral crescents; usually two preoculars; infralabials usually ten, often nine.

Type Locality.—Parras, Coahuila, Mexico.

Synonyms.—Chilopoma rufopunctatum Cope, 1875; type locality "Southern Arizona." *Atomarchus multimaculatus* Cope, 1883; type locality San Francisco River.

Range.—This species occurs in the northern part of the Mexican plateau south to Coahuila and Durango and north to portions of southwestern New Mexico and southern and central Arizona. The original Arizonan specimen was labeled merely "Southern Arizona," and no definite locality in that state was recorded until our specimens were secured at

1. Oak Creek, Coconino County, Arizona.

Material.—We have eighteen snakes of this species from the above locality.

Variation.—The loreals are 1—1 in seventeen and 1—2 in one. The preoculars are 2—2 in sixteen, or 89%; 2—3 in two, or 11%. The postoculars are 3—3 in ten, or 56%; and 3—4 in eight, or 44%. The temporals are 1+1—1+1 in nine, or 50%; 1+1—1+2 in eight, or 44%; and 1+2—2+2 in one, or 6%. The supralabials are 8—8 in thirteen, or 72%; 7—8 in two, or 11%; 8—9 in two, or 11%; and 7—7 in one, or 6%. The infralabials are 10—10 in nine, or 53%; 9—10 in four, or 24%; and 9—9 in four, or 24%. The scale-rows are 21—19—17 in all. The gastrosteges vary in number from 161 to 177, males having from 165 to 177, females from 161 to 170; the average in eleven males is 171.3, in seven females, 164.9. The urosteges vary from 69 to 87, males having from 80 to 87, females from 69 to 82; the average in eleven males is 84.2, in seven females, 73.9. These variations are shown in full in the following table of scale-counts.

Number	Sex	Scale rows	Gastro-steges	Uro-steges	Supra-labials	Infra-labials	Pre-oculars	Post-oculars	Loreals	Temporals	Local-ity
35238	♂	21—19—17	175	85	8—8	10—10	2—2	3—3	1—1	1+1——1+1	1
35239	♀	21—19—17	165	69	8—8	9—9	2—2	3—3	1—1	1+1——1+1	1
35240	♀	21—19—17	170	82	8—7	9—10	2—2	3—3	1—1	1+2——1+1	1
35241	♂	21—19—17	170	84	8—9	9—10	2—2	3—3	1—1	1+2——1+1	1
35242	♀	21—19—17	166	72	8—8	10—10	2—2	3—3	1—1	1+1——1+1	1
35243	♀	21—19—17	165	75	8—8	10—10	2—2	3—4	1—1	1+1——1+1	1
35244	♂	21—19—17	177	87	8—8	9—10	2—2	3—3	1—1	1+1——1+2	1
35245	♂	21—19—17	171	85	8—8	10—X	3—2	3—4	1—1	1+1——1+2	1
35246	♀	21—19—17	166	73	8—9	9—10	2—2	3—4	1—1	1+1——1+2	1
35247	♂	21—19—17	172	80	8—8	10—10	2—2	3—4	1—1	1+1——1+1	1
35248	♀	21—19—17	161	72	8—8	10—10	2—2	3—4	1—1	1+1——1+1	1
35249	♂	21—19—17	172	83	8—8	10—10	2—2	3—4	1—1	2+2——1+2	1
35250	♂	21—19—17	173	86	8—8	10—10	2—2	3—3	1—1	1+1——1+1	1
35251	♂	21—19—17	176	87	8—7	9—9	2—2	3—3	1—1	1+1——1+2	1
35252	♂	21—19—17	167	80	8—8	10—10	2—2	3—4	1—1	1+1——1+2	1
35253	♂	21—19—17	165	83	8—8	10—10	2—3	3—4	1—1	1+2——1+1	1
35254	♂	21—19—17	166	86	7—7	9—9	2—2	3—3	1—1	1+1——1+1	1
35255	♀	21—19—17	161	74	8—8	9—9	2—2	3—3	1—1	1+1——1+1	1

Remarks.—No. 35248 has the anal divided. The posterior genials are either equal to or longer than the anterior.

Oak Creek is a mountain stream running through a deep canyon with many oak trees. Perhaps a thousand feet above the stream is the pine forest of the plateau of central Arizona. These snakes were found in the stream, either on rocks or in the water. Their general appearance is very different from that of most garter-snakes. The absence of lines, the heavy spotting, and the long, narrow head are not suggestive of *Thamnophis*.

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NEW SPECIES OF HEMIPTERA CHIEFLY FROM CALIFORNIA

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Of the 39 species described in this paper 26 were taken during my field work in southern California in May and June, 1917. The principal places visited were Coachella, a little north of the Salton Sea, having a depression of 76 feet below sea level; Palm Springs at the northwestern edge of the desert near the foot of the San Jacinto Mountains, with an elevation of about 425 feet above sea level; Soboba Springs in the San Jacinto Mountains near the town of San Jacinto, with an elevation of about 2,000 feet; Keen Camp in the San Jacinto Mountains at an elevation of 4,800 feet, with excursions on Mt. Tahquitz to 8,000 feet, and Colton, in San Bernardino County, with an elevation of about 800 feet. Unless otherwise stated, all localities are in California and all specimens from California were taken by myself.

1. **Trichopepla vandykei**, new species

Narrower and more clearly marked than *semivittata* with a shorter head. Length 7—8½ mm.

Head scarcely longer than its width across the eyes, less narrowed at tip than in *semivittata*, with the sides more abruptly arcuated there. Second antennal segment scarcely longer than the third, sometimes obviously shorter, in *semivittata* usually a little longer. Rostrum not surpassing the

hind coxæ, in *semivittata* usually reaching on to the second ventral segment; both species having the basal segment longer than the bucculæ. Carinate margins of the pronotum regularly but feebly arcuated; in *semivittata* straight or feebly sinuated at the middle. Upper surface smoother with more regular and shallower punctures than in the allied species. Genital segment of the male short as in *semivittata*, but with its apical margin roundedly excavated, its basal angles scarcely notched. Claspers with the ventral angle produced outwardly in an acute rounded hook which almost conceals the rounded apex when viewed from below.

Color pale yellowish testaceous, marked with areas of black punctures as follows: a band on either margin of head before the eye superiorly and a broader one inferiorly; a broad vitta down either side of the pale median line, expanded so as to cover most of posterior disk of vertex, and four well defined rays on anterior half of pronotum. Basal half of scutellum polished black, crossed by three conspicuous pale calloused vittæ. Beneath with a fuscous or black cloud on side of pro- and meta-pleuræ, and some faint clouds on mesopleuræ. Venter pale, with indications of lateral vittæ in the female, the male claspers lineate with black. Punctures on pale portions of upper surface more or less infuscated. Membrane uniformly whitish in male, faintly fuliginous in female. Legs pale, immaculate except for a darkening on tips of tarsi. Hairy vestiture long, soft and pale as in *semivittata*.

Described from one male and two female examples taken in San Francisco, September 16, 1906, by Dr. Edwin C. Van Dyke, after whom the species is named. So far as known to me, this is the most clearly marked of all our species of *Trichopepla*. It may become more suffused under other conditions.

Holotype (No. 383), male, allotype (No. 384), female, and paratype, in collection of the California Academy of Sciences.

2. **Trichopepla californica**, new species

Aspect of *atricornis* but with a shorter head and a maculated connexivum. Length 6½ to 8 mm.

Head distinctly shorter than its width across the eyes; broadly rounded or truncated at apex, the sides parallel or nearly so for a space before the ante-ocular sinus. Third antennal segment not longer than second. Sides of pronotum almost rectilinear for a space at the middle, moderately expanded as in *semivittata*. Upper surface deeply punctured with black, the ray-like markings much obscured. Male genital segment trisinuately excavated, with its lateral angles strongly notched. Claspers obliquely produced at apex as in *semivittata*, with their ventral angle produced in an acute, incurved hook as in *vandykei*. Rostrum short, scarcely exceeding the intermediate coxæ.

Color as in *semivittata* but with the ray-like markings more obscured by large black punctures. The carinate pronotal margins seem always to be pale and usually the median line of the pronotum and the three calloused vittæ of the scutellum are conspicuous. Beneath the sternum is black and there is a black lateral vitta on the pleuræ and sides of the venter, the latter placed halfway to median line. Male with disk of venter mostly black. Legs testaceous-brown or more or less infuscated. Antennæ nearly black, connexivum about equally alternated with pale and black. Membrane quite deeply infuscated.

Described from four male and 15 female examples representing the following localities: Mt. Tallac, Calif., 8,500 feet, July 17, 1915, numbers taken running on the ground on a sloping alpine meadow, by Dr. E. C. Van Dyke and myself; Paradise Park, Mt. Rainier, Wash., 6,000 feet, July 14, 1906, Dr. E. C. Van Dyke; Prairie Hills, B. C., July, 1908, Selkirk Mountains, B. C., July, 1908, and Sisson, Calif., August 19, 1908, Dr. J. C. Bradley; Moscow, Idaho; Sierra Madre Mountains, Mexico, September.

This species may be recognized by the short, blunt head, the short rostrum, the obscured coloration, and the black vitta on either side of the venter.

Holotype (No. 385), male, and allotype (No. 386), female, from Mt. Tallac, in collection of the California Academy of Sciences. Paratypes in the collections of the California Academy of Sciences and in that of the author.

3. **Trichopepla aurora,** new species

Aspect of a large *semivittata* but with a somewhat shorter head and rounded, calloused pronotal margins. Length 8½ to 9 mm.

Head as long as its width across the eyes; narrowed from the anteocular sinus, with rounded apex. Second antennal segment distinctly longer than third. Rostrum just passing the intermediate coxæ. Surface above coarsely, irregularly punctured with fuscous and black; connexivum alternated. Membrane infuscated. Genital segment of male broad, its apical margin shallowly, trisinuately excavated; claspers very broad, truncate, their apical margins rectilinear, not showing beyond the acutely produced ventral angle.

Color as in *semivittata,* well obscured by black punctures; ray-like markings of head and anterior lobe of pronotum distinct, those on base of scutellum mostly represented by three pale calloused spots. Calloused sides of the pronotum pale, not at all elevated but rounding over in conformity with the adjoining surface. Black alternations on the connexivum weakened by pale interpunctural spaces. Venter showing faint indications of six longitudinal darker vittæ. Antennæ mostly black. Legs pale, more or less obscured by minute blackish punctures.

Described from three males taken in El Dorado County, Calif., June 20, 1915, by F. W. Nunenmacher, one female taken by me at Ross Valley, Marin County, Calif., April 28, 1918, and one female from Gallatin County, Mont., taken June 22, 1900, at an elevation of 7,000 feet, by E. Koch. The

ecarinate sides of the pronotum and very broad male claspers will distinguish this species.

Holotype (No. 387), male, from El Dorado County, in collection of the California Academy of Sciences.

Allotype (No. 388), female, from Ross, Calif., in collection of the California Academy of Sciences.

Paratypes in both collections and in that of Mr. L. R. Reynolds.

4. **Trichopepla grossa**, new species

Aspect of a *Carpocoris* but with the longer and more attenuated odoriferous canal of *Trichopepla.* More uniform in color than our other species of *Trichopepla,* the radiating vittæ conspicuous only on head and anterior field of pronotum. Length 9 to 10 mm.

Head nearly vertical, as long as its width across the eyes, narrowing anterior to the ante-ocular sinus; cheeks slightly surpassing the tylus. Second antennal segment longer than third. Rostrum attaining the intermediate coxæ. Carinate sides of pronotum calloused but scarcely reflexed, continuing the slope of the pronotal surface. Male genital segment feebly, trisinuately excavated at apex. Claspers broad, truncate, their ventral angle produced outwardly in a sharp bent tooth. Membrane fuliginous. Upper surface regularly deeply punctured.

Color yellowish testaceous, fusco-punctate, the punctures concolorous beneath and on apex of scutellum. Fuscous ray-like vittæ distinct anteriorly, fading out toward middle of pronotum. Antennæ black with the first and base of second segment pale. Legs pale or obscurely punctate. Connexivum black, broadly margined with pale. One male is almost entirely black with the apex of the scutellum and the connexivum pale, the legs strongly punctured with black and the pleuræ with lateral vittæ of black punctures.

Described from two males and two females. One black male from Julietta, Idaho, and two females from Moscow and Market Lake, Idaho, were received from Prof. J. M. Aldrich. The other male was taken at Castella, Calif., by Mr. J. A. Kusche, July, 1912.

Holotype (No. 389), male, from Castella, Calif., in collection of the California Academy of Sciences.

Allotype, female, from Moscow, Idaho, and paratypes in collection of the author.

The following table will distinguish the species of *Trichopepla* known to me:

Sides of pronotum carinate, sometimes quite broadly reflexed.......... 1
Sides of pronotum calloused, ecarinate, continuing the slope of the disk 4
1. Head longer than width across the eyes, apex narrower and more produced; sides approaching before the ante-ocular sinus; rostrum at least attaining apex of hind coxæ........................... 2
-. Head not longer than width across the eyes, rounded at apex with the sides parallel for a space before the ante-ocular sinus; rostrum not surpassing the base of the hind coxæ....................... 3
2. Head distinctly longer than width across the eyes; apex narrow, parabolic, but little arcuated; second antennal segment obviously longer than third; membrane infuscated; posterior disk of pronotum coarsely irregularly punctured, male genital segment trisinuately excavated; calloused lines on base of scutellum more or less broken and obscured ....*semivittata* Say.
-. Head scarcely longer than width across the eyes; apex broadly rounded; second and third antennal segments subequal; membrane whitish hyaline; posterior disk of pronotum closely, finely punctured; male genital segment deeply, roundedly excavated; three calloused lines on base of scutellum very distinct and regular.... ....*vandykei*, new species
3. Connexivum black, its margin quite broadly pale....*atricornis* Stål.
-. Connexivum alternated with black at incisures.................... ....*californica*, new species
4. Margin of connexivum broadly pale............*grossa*, new species
-. Margin of connexivum alternated..............*aurora*, new species

5. **Carpocoris sulcatus**, new species

Allied to *remotus* but differing in the longer head and membrane, narrower scutellum and more maculated surface. Length 9 to 10 mm.

Head a little longer than width across the eyes, in *remotus* a little shorter; cheeks narrower, making the head look still longer. Sides of pronotum a little sinuated, in *remotus* feebly arcuated. Scutellum more narrowed beyond the frenulum with its apex more angulate, the base calloused and bevelled, leaving a deep groove behind the pronotal margin. Membrane surpassing abdomen for nearly one half its length beyond tip of corium. Rostrum attaining apex of hind coxæ, the basal segment scarcely reaching the apex of the bucculæ. Second antennal segment little if any longer than third. Genital segment of male deeply trisinuate, the median lobe less deeply cleft than in *remotus;* claspers broad, truncate, with their ventral angle produced exteriorly; viewed from below these claspers are curved outward, oblique at tip, with the outer angle subacute.

Color pale yellowish testaceous with four black ray-like vittæ, more or less distinct, on head and anterior field of pronotum. Base of scutellum with a blackish cloud either side of a pale median vitta sometimes confined to the calloused depressed base. Punctures of upper surface sometimes darkened in places. Connexivum maculated in mature examples. Antennæ black, with basal segment and extreme base of second pale. Beneath and legs pale, immaculate, apex of tibiæ and tarsi somewhat infuscated.

Described from one male taken at Alpine, San Diego County, Calif., October 3, 1913, on grass under oak trees; one male taken by F. W. Nunenmacher in Mariposa County, Calif., June 15, 1914; one female taken by Dr. F. C. Clark, in Bear

Valley, Santa Cruz Mountains, in August, 1913, and one female taken by me near Redding, Calif., July 7, 1918. This species is a little larger than *remotus* and may be distinguished by the narrower and longer head, different relative lengths of the antennal segments, shorter basal segment of the rostrum, the black markings of the upper surface of the head, pronotum, scutellum and connexivum, and, especially, by the calloused and bevelled base of the scutellum. The colors are doubtless subject to variation but here there is none of the pink tint found on the corium of *remotus*. The male genital characters do not differ materially from those of *remotus* so far as can be seen without dissection.

Holotype, male from San Diego County, in collection of the author.

Allotype (No. 390), female from Bear Valley, and paratypes in collection of the California Academy of Sciences.

6. **Brochymena sulcata**, new species

Closely allied to *4-pustulata* and *affinis* and somewhat intermediate between those species, but quite distinct in its male genital characters; cheeks more produced before the tylus; arolia narrower; male genital segment transversely sulcate, the claspers narrower, elliptical; length 12-15 mm.

Head as long as the pronotum on its median line; cheeks surpassing the tylus by their own width at that point, their inner margins at the sinus parallel or diverging, not approaching or overlapping as is usually the case in *4-pustulata*, their lateral tooth rectangular. Segments two to five of the antennæ subequal in length, the third sometimes a little longer, normally so in *4-pustulata*. Rostrum attaining the middle of the second ventral segment. Pronotum across the humeri a little more than twice broader than its median length; lateral margins before the sinus with four to six triangular flattish teeth that merge into the adjoining surface, the humeri with six to eight serrations or small teeth; in *4-pustulata* these lateral teeth are more terete and calloused and sometimes are curved backward. Exserted ostiolar canal tongue-shaped, narrowed at base, rather longer than the external diameter of the orificial tube; in *4-pustulata* lanceolate, broadest at base, and distinctly shorter. Male genital segment almost attaining the outer angle of the sixth ventral segment, its apical margin transversely sulcate, omitting the smoothly rounded median excavation; either side the sulcus clothed with long pale hairs; claspers elliptical ventrally, in *4-pustulata* broadly rounded. Other structural characters substantially as in *4-pustulata*.

Color above as in the allied species; beneath pale with the marginal alternations, slender edge of the segments, stigmata, a line behind them, and a spot on the middle of the sixth segment blackish. Femora fuscous with their base, an apical and a subapical spot pale, the latter often produced basally as a vitta. Tibiæ with a broad median pale annulus carrying a fuscous spot on the exterior face; the posterior rarely marked with a pale

basal spot exteriorly. Antennæ black with the incisures very slenderly pale. Rostrum pale with its median line and apex black.

Described from six male and twelve female examples taken as follows: San Diego, Calif., April, June, October and December, taken by myself; Los Angeles, Calif., April, M. C. Van Duzee; San Jacinto Mountains, 5000 ft., June, and Kemlo, Calif., June, Fordyce Grinnell; Cisco, Calif., July, C. von Geldern; Sobra Vista, Sonoma County, Calif., April, and south Sonoma County, Calif., June, J. A. Kusche; Martinez, Contra Costa County, Calif., J. C. Grundell; Santa Cruz Mountains, Chas. Fuchs; western San Joaquin County, Calif.; and Preston, Ariz., J. A. Kusche. I have heretofore determined this species as *4-pustulata* and it seems to represent that species west of the Rocky Mountains.

Holotype (No. 391), male, from San Diego, in collection of the California Academy of Sciences; allotype, female, from San Diego in collection of the author; paratypes in both collections.

7. **Harmostes angustatus**, new species

Allied to *fraterculus* but with the antennæ longer with longer basal segment, the bucculæ lower and the colors paler. Length 7 to 8 mm.

Head as in the allied species, the clypeus broader and less elevated than in *reflexulus* or *fraterculus;* bucculæ lower than in *fraterculus,* scarcely surpassing anterior line of eyes, becoming almost evanescent posteriorly. Rostrum long, attaining base of second ventral segment; first segment reaching to within its own width of the base of the head. Antennæ long, slender; first segment clavate, surpassing the clypeus by one fourth its length; second as long as the head and equal to third, these segments unusually slender. Pronotum a little shorter than the head; sides irregularly arcuated, strongly carinated but not expanded or reflexed except for a short space at anterior angle, which is rounded with the usual prominent tooth; hind edge almost straight, disk with a distinct median carina which hardly attains the anterior margin. Scutellum distinctly tricarinate, its apex deeply impressed and upturned. Elytra parallel, the costa rectilinear from near its base; median areole of corium hyaline, the inner partly so. Venter deeply sulcate to fifth segment. Male claspers unusually slender, viewed from the side oblique at apex and much produced dorsally, median process acute or subacute.

Color pale testaceous-brown or tinged with green or yellow, more or less marked with fuscous, this color forming four obscure spots on hind margin of pronotum and clouding apical half of clavus and apex of corium; the nervures dotted with fuscous. Membrane whitish hyaline, obscurely dotted at times. Tergum deep black with a pale median vitta from base of the fourth segment, expanded posteriorly; apical segment with two black vittæ in male. Head, pronotum, scutellum, coriaceous portions of elytra, legs and often lower surface of body coarsely punctured with brown or rufous. A few individuals show the rosy tints on the clavus often found in the allied species.

Described from ten males and seven females. I have taken this species at Mussey's in San Diego County, Palm Springs, May 18 to 23, and Keen Camp in the San Jacinto Mountains, Calif., June 6, to 12, 1917, and have examples in my collection from El Paso, Texas, taken April 5, 1902; Alamogordo, N. Mex., taken June 9, 1902, and Bill Williams' Fork, Ariz., taken by Prof. F. H. Snow in August. At Palm Springs it was taken with its young on *Hymenoclea salsola* T. &. G. The short bucculæ and narrow pronotal margins will distinguish this species. These carinate margins are at times more or less crenulate but not strongly as in *affinis* and its allies.

Holotype (No. 392), male, and allotype (No. 393), female, from Palm Springs in collection of the California Academy of Sciences.

Paratypes in collection of the California Academy of Sciences and in that of the author.

The North American species known to me may be distinguished as follows:

Lateral margins of pronotum distinctly serrated...........*affinis* Dall.
Lateral margins of pronotum obscurely granulated or smooth......... 1
1. Lateral margins of pronotum carinated but not reflexed; bucculæ attaining anterior margin of eyes.........*angustatus*, new species
-. Lateral margins of pronotum broadly expanded and reflexed....... 2
2. Color croceus or reddish; rostrum short; base of vertex without a groove ....*croceus* Gibson
-. Color more yellowish or testaceous; base of vertex with a median groove 3
3. Basal segment of antennæ scarcely surpassing clypeus; bucculæ not surpassing anterior line of eyes; membrane bivittate............ ....*fraterculus* Say.
-. Basal segment of antennæ much surpassing clypeus; bucculæ attaining hind margin of eyes; membrane without vittæ......*reflexulus* Say.

8. **Teleonemia vidua**, new species

Closely allied to *nigrina*, proportionately a little longer with more slender antennæ; color a uniform dark fuscous with the head and basal segment of the antennæ black. Length 4 mm.

Elongate, narrow; elytra nearly parallel, a little expanded at the middle. Vertex with two short porrect frontal spines, the anterior just above the line connecting the base of the antennæ, the posterior continuing the superior line of the vertex. Antennæ longer and more slender than in *nigrina*, clothed with very short hairs; segments one and two sub-equal; four scarcely as long as one and two together, fusiform with cinerous pubescence at apex; three nearly three times the length of four. Pronotum less convex than in *nigrina* with posterior scutellar portion longer, the anterior margin not elevated nor produced medially; carinæ feeble; surface

rugose but scarcely punctured, becoming obscurely areolate posteriorly. Rostrum almost attaining hind edge of mesosternum, the rostral canal nearly parallel on the mesosternum, (metasternum covered in mounting). Discal area of corium coarsely and deeply punctured; subcostal area, narrow, obscurely biseriate; costal very narrow, whitish, the areoles longer than broad and distinguished by heavy veinlets. Membrane regularly distinctly areolate. Genital segment of female armed with a long pilose protuberance either side. These are not broadly divergent as in *nigrina* but diverge at first and are then bent backward so as to become parallel, their apices flattened and rounded. In *nigrina* these protuberences may be reduced to mere tubercles and the same may be true in the present species.

Color a nearly uniform fuscous becoming still darker beneath. Head and basal segment of antennæ black; costal areoles whitish; tibiæ pale, a little darker at base. Head, antennæ and legs somewhat polished.

Described from one female example taken at Keen Camp in the San Jacinto Mountains, June 8, 1917, at an elevation of nearly 6,000 feet. This is so evidently distinct from the related species it seems safe to describe it from a single example.

Holotype (No. 394), female, in collection of the California Academy of Sciences.

9. **Teleonemia monile**, new species

Broader and more clearly marked than *nigrina;* subcostal area with two series of very distinct hyaline areolæ; antennæ short and stout. Length 4 mm.

Tubercles of the vertex small and inconspicuous; Antennæ short and thick as in *nigrina;* basal segment short-pilose, the third hardly more than twice the length of the fourth, the latter shorter than the basal two united. Pronotum nearly as in *nigrina*, the flattened anterior portion more angularly produced and distinctly areolate at the middle; posterior scutellar portion coarsely areolate; carinæ very distinct, subfoliaceous and areolate. Elytra considerably expanded at the middle, broader and truncate at apex; discal area very coarsely punctate, the punctures becoming subareolate exteriorly; subcostal area broad, distinctly biseriate, the areoles whitish hyaline; costal area rather broad, hyaline,, the areoles elongated, separated by heavy veinlets. Membrane distinctly areolate. Rostrum about reaching hind margin of mesosternum; rostral canal broad on mesosternum and a little narrowing posteriorly. Female genital segment with a large rounded and flattened tubercle either side.

Color cinereous brown becoming lighter on the pronotum posteriorly and on the elytra; most of the elytral veinlets and the interstices between the punctures fuscous; linear costal area alternated with blackish and white, giving it a beaded appearance; beneath more fusco-ferruginous. Tibiæ pale on their apical two thirds. Second and third antennal segments quite strongly tinged with castaneous.

Described from one male and three female examples taken by Prof. H. F. Wickham at Lundy, Mono County, Calif., July 8-10, at an elevation of nearly 8000 feet. The broader form, short stout antennæ, distinctly areolate elytra, conspicuously

biseriate subcostal area and clearly marked moniliform costal area, which is continued about the apex of the elytra, will distinguish this species.

Holotype, male, and allotype, female, in collection of the author.

Paratypes in collection of the California Academy of Sciences and in that of the author.

Our California species of *Teleonemia* may be distinguished by the following key:

Subcostal area biseriate 1
Subcostal area uniseriate 2
1. Subcostal area conspicuously biseriate; pronotal carinæ conspicuous; large brown species .... *monile*, new species
–. Subcostal area narrow, obscurely biseriate; pronotal carinæ inconspicuous; smaller cinereous species .... *schwarzi* Drake.
2. Antennæ stouter; third segment about twice the length of the fourth; costal area conspicuously areolate; color fuscous varied with cinereous .... *nigrina* Champ.
–. Antennæ more slender; third segment nearly three times the length of fourth; costal area very narrow, obscurely areolate; color brown, nearly uniform, with the head black ... *vidua*, new species

10. Oncerometopus californicus, new species

Larger and darker than *nigriclavus;* sanguineous, antennæ, legs, callosities, clavus, inner field of corium, membrane and genital segment black; disk of pronotum more or less infuscated either side of the pale median line. Length to tip of membrane 6½ mm.

Vertex and tylus rather more convex than in *nigriclavus*. Antennæ with the second segment distinctly longer than in *nigriclavus*, a little longer than the pronotum; third and fourth together a fourth shorter than second, in *nigriclavus* nearly a fourth longer. Pronotum proportionately longer, its length two fifths its basal width, in *nigriclavus* scarcely more than one half; sides nearly rectilinear, a little expanded at the humeral angles; collum as long as the thickness of first antennal segment; callosities prominent, distinguished by a deep incision which is especially distinct behind the median bridge connecting them anteriorly. In *nigriclavus* this incised line is not conspicuous and behind the median bridge is represented by two impressed punctures; surface transversely rugose with scattering shallow punctures and an obvious obtuse median carina; hind margin almost truncate. Elytra nearly parallel, a little expanded at the middle, the embolium narrowly linear, distinct; surface polished, distinctly uniformly shagreened, in *nigriclavus* more opaque and but obscurely shagreened. Apex of abdomen in both sexes reaching midway between the tip of the cuneus and that of the membrane. Tibiæ short-setose. Tarsi; basal segment scarcely expanded, second a little shorter than median length of first, in *nigriclavus* hardly half that length. Male genital characters rather obscure, the dextral hook lunate, a little narrowed posteriorly and lying against the excavated margin of the segment.

Color sanguineous, obscured on the vertex and pronotum; clypeus, antennæ, legs, callosities, clavus, inner field of corium, membrane and genital segments black; vertex, at least posteriorly, and disk of pronotum more or less infuscated, the collum, sides and median line remaining paler. Antennæ in the male testaceous with the first segment and narrow base of the second black; third and fourth in the female often paler.

Described from one male and ten female examples taken from the flowers of a bush sunflower growing along the road at Soboba Springs, near San Jacinto, Calif., June 1, 1917. Both this species and *nigriclavus* vary considerably in the extent of their dark markings but the characters given seem sufficient to separate them.

Holotype (No. 395), male, allotype (No. 396), female, and paratypes, in collection of the California Academy of Sciences.

11. **Neurocolpus simplex**, new species

Allied to *mexicanus*, proportionately shorter and broader than *nubilus* with basal segment of antennæ and hind femora more thickened; color yellowish, inclined to fulvous, the hairy vestiture white. Length 6½ to 7 mm.

Head about as in *nubilus*, the tumid vertex scarcely projecting beyond the line of the clypeus. Basal segment of antennæ clavate, shorter than in *nubilus* and thicker at apex than in either of our other species, its hairy vestiture silvery white, the hairs less flattened than in the allied forms; second segment almost twice the length of first, shaped as in *nubilus*, less clavate than in *mexicanus*; third and fourth together subequal to first, slender. Pronotum as in *nubilus*, its length one half its basal width, clothed with short matted scale-like hairs; collum not so strongly distinguished as in the allied species. Rostrum reaching to apex of the intermediate coxæ. Abdomen somewhat expanded, the connexivum surpassing the elytra in some examples.

Color obscure fulvous or honey-yellow, becoming clearer yellow on posterior disk of pronotum, apical lobe of scutellum, and base of elytra; the whole surface clothed with a white vestiture of scale-like hairs which show an inclination to form three lines on the vertex, to become somewhat matted on the pronotum, and are larger and more conspicuous on the legs. Membrane whitish hyaline with the nervures yellowish, becoming more or less infuscated at base. Sometimes there is a faint fuscous cloud on outer margin of membrane before its apex. One immature example has the apex of the tibiæ and of the embolium greenish.

Described from four females taken on the palo-verde, *Cercidium torreyanum*, among the foothills west of Coachella, Calif., May 16, 1917. This species is very distinct in its pale color, white vestiture and the form of the antennal segments.

Holotype (No. 397), female, and paratypes in the collection of the California Academy of Sciences.

12. Phytocoris plenus, new species

Very close to *inops* Uhl.; differing in the absence of a pale median annulus on second antennal segment, the more produced head and form of the male genitalia. Length 7 mm.

Head prominent, nearly vertical; viewed from the side extending below the eye for a space equal to about three fourths the greatest length of the eye; clypeus prominent, convex; gula oblique. In *inops* the head projects hardly more than one half the greatest length of the eye, the clypeus is less prominent and the gula is but slightly oblique. Rostrum long, in the male passing the apex of the fourth ventral segment, the basal segment broadly linear, attaining the middle of the anterior coxæ. Vertex viewed from above flat, obviously wider than the eyes; tumidly convex before; in *inops* not wider than the eyes and less convex before. Antennæ about as in *inops*, the first segment a little longer. Pronotal collum strongly differentiated; in *inops* but feebly so. Elytra with three polished areas, the basal but poorly distinguished; the apical conspicuous, resting on the base of the cuneus. Hind femora long, almost attaining the apex of the membrane. Apical margin of last ventral segment of male thickened, produced in a subacute angle; sinistral notch right-angled, terminating above in a blunt, blackish tooth which usually is somewhat longer than its width. In *inops* this tooth is longer, terete and much more slender. Dextral notch nearly as deep as the sinistral but more rounded at its fundus. In *inops* the ventral apex of this segment is less acute with both notches more rounded, the dextral shallower.

Color cinereous mottled with fuscous as in *inops* but with the markings more contrasted. Vertex distinctly striated anteriorly, its disk paler. Disk of pronotum paler; median line at base, sides and anterior angles infuscated; posterior submarginal line broken into dots, or nearly so. Antennæ fuscous, without pale annulations; the basal segment dotted with pale; the extreme base of segments two and three white. Scutellum distinctly varied with pale and fuscous, the anterior lobe fuscous with three pale marks, its apex conspicuously pale. Elytra rather evenly mottled with the costa dotted; corium with the three polished areas paler; cuneus pale within, its outer and inner margins varied with fuscous. Membrane evenly irrorate as in *inops*, its outer margin with two clear spots, the anterior at apex of the cuneus; nervures pale becoming fuscous at base. Legs irrorate with fuscous; coxæ and narrow base of femora white, the former bivittate with fuscous; tibiæ fuscous irrorate with white and marked with four white rings which are subequal to their interspaces, the basal on the hind pair obscure; tarsi fuscous with a pale annulus. Rostrum pale with its apex broadly fuscous. Sternum fuscous. Venter white, irrorate with fuscous, with a narrow pale vitta and a few orange dots on either side, the genital segments mostly fuscous. Behind each eye is a small tuberculate ivory mark and behind that is a larger one on the incised line of the collum.

Described from one male taken at Keen Camp in the San Jacinto Mountains, June 8, 1917; one male taken on the hills at Foster, San Diego County, April 11, 1914, and two males taken at Lakeside, San Diego County, Calif., May 5, 1913. I have seen no females I could certainly associate with these males.

This species is closely allied to *inops* but it is well distinguished by the characters given above. In the allied forms the

female has the vertex broader and the rostrum shorter than their males and the same may be true in this species. For ready recognition the banding of the tibiæ will be found a convenient character: In *plenus* the anterior tibiæ are narrowly black at either end with three dark rings between; in *inops* and related forms the apical ring is broad and there are but two between that and the narrow basal one. In *inops* the second antennal segment is fuscous with a pale median annulus. In the San Diego County males of *plenus* the basal half of the second antennal segment is paler.

Holotype (No. 398), male, from Keen Camp, in collection of the California Academy of Sciences.

Paratypes in the collection of the author.

13. **Phytocoris fraterculus,** new species

Allied to *inops,* averaging larger and darker with a longer head and wanting the median pale annulus on second antennal segment. Differs from *plenus* in the shorter pronotum and by the presence of a distinct pale annulus near the apex of the hind femora, and from both species by the characters of the male genitalia. Length 7 to 7½ mm.

Head produced below the eye for a space nearly equal to the length of the eye; clypeus prominent; gula oblique; cheeks prominent, rounded, not angularly produced as in *inops.* Vertex flattened, scarcely advanced to the line of the clypeus, not projecting before it as in *inops.* Rostrum attaining apex of second ventral segment; its first segment reaching to middle of anterior coxæ. Antennæ slender; first segment linear, hardly longer than the pronotum; second equal to the costal margin of corium; third about equal to first; fourth two-thirds the third; first armed with stiff hairs which are a little longer than the thickness of the segment. Pronotum short, its length one half its basal width; sides rectilinear; base slightly emarginate; collum distinct as in *plenus.* Elytra with three polished areas as in *plenus.* Legs long, about as in *plenus;* the hind femora reaching nearly or quite to apex of membrane, distinctly shorter than in *inops.* Sinistral margin of the genital segment with its superior angle unarmed, rounded; the sinistral hook long and curved as in *inops,* with a rounded notch at base; ventral aspect of the genital segment rounded or subacute at apex about as in *inops.* Surface clothed with close black pubescence and softer white deciduous hairs.

Color cinereous mottled with fuscous as in the related species, sometimes pale brownish and fuscous. Vertex distinctly striate; clypeus, loræ and cheeks brown, bordered with pale; hind margin of the eye and usually a median spot on base of vertex whitish. Pronotum brown or fuscous becoming pale about the callosities and blacker toward the margins; the hind edge narrowly white behind a blackish vitta which may become broken into six lobes or spots. Scutellum brown with basal angles and a geminate median

line fuscous and the sagitate apex white. Elytra cinereous or brown with a darker, usually irrorate, area along the claval suture and on the radial vein and costa; apical polished area angulate, pale, and invading the base of the cuneus; margins of the cuneus variegated with black and pale. Membrane about as in *plenus;* white, rather closely and evenly irrorate with fuscous but shading darker toward its base; margin darker, alternated with two white spots beyond tip of cuneus; nervures brownish, the radial sometimes blackish. Beneath fuscous-brown; coxæ and sometimes disk of venter pale. Legs fuscous, irrorate with whitish and sometimes pale at base; hind femora with an oblique pale subapical vitta and in the female a pale ray from the base to near the middle; tibiæ showing three, more or less distinct, pale bands, one, before the middle of the hind pair, unusually distinct. Antennæ fuscous; basal segment irrorate with pale; extreme base of second and third segments white, the second without a pale median annulus.

Described from three male and eleven female examples taken at the following localities: Yosemite, Calif., June 16, 1916; Fallen Leaf Lake, Calif., August 21, 1916, 6300 feet; Tallac, Calif., August 22, 1916. 6000 ft., Soda Springs, Nevada County, Calif., 6800 ft., August 24, 1916; all taken by Mr. Walter M. Giffard; Bright Angel Camp, Ariz., 6900 ft., H. F. Wickham, and Pine Hill in the Cuyamaca Mountains, San Diego County, Calif., Oct. 19, 1913, 4300 ft., taken by myself.

Holotype (No. 399), male, and allotype (No. 400), female, from Yosemite, in collection of the California Academy of Sciences.

Paratypes in collection of Mr. Walter M. Giffard and in that of the author.

14. **Phytocoris hirtus**, new species

Aspect of *plenus* but readily distinguished from that and other allied forms in having the upper surface clothed with unusually long hairs, especially upon the legs. Length 8½ mm.

Head oblique, produced before the eye for a distance about equal to the greatest length of the eye; cheeks tumidly convex but somewhat less so than in *inops;* Vertex convex and swollen along the line of the clypeus much as in *inops.* Rostrum reaching well on to the third ventral segment. Antennæ slender; first segment as long as basal width of pronotum, slightly thickened basally; second segment nearly twice the length of first; third and fourth together as long as second; first sparsely clothed with long pale hairs which are at least twice as long as the thickness of the segment. Pronotum long and well narrowed anteriorly as in *plenus,* the sides a little convex; hind edge a little emarginate; collum distinct; callosities small and inconspicuous. Elytra long with the costa slightly arcuated; venter reaching to tip of cuneus. Upper surface and head clothed with nearly erect brown hairs which are almost as long as the thickness of the hind tibiæ and are interspersed with short scale-like deciduous hairs. Legs clothed with soft pale hairs as long as the thickness of the anterior femora.

Color about is in *plenus;* pale brownish or cinereous varied with fuscous; disk of clypeus, loræ and cheeks and two vittæ behind the eyes which are continued across the inferior aspect of the pronotum, fuscous; frontal striæ distinct. First segment of antennæ whitish, with a series of dots and the broad apex fuscous; second segment pale brown, broadly white at base becoming fuscous at apex and next the pale basal annulus; third and fourth segments fuscous. the third narrowly pale at base. Pronotum becoming paler anteriorly and almost black before the narrow white posterior margin. Scutellum variegated with a pale apex. Elytra with the three polished areas paler, the posterior whitish and extended so as to cover basal half of cuneus; apex of corium and cuneus blackish. Membrane irregularly irrorate, the areoles and apex darker. Beneath pale or yellowish, the pleural pieces mostly infuscated. Sides of venter mottled with fuscous with indications of a paler longitudinal vitta below the stigmata. Legs pale, the femora irrorate with brown, especially above; the tibiæ with four fuscous annuli, more or less distinct.

Described from two females from southern California, one taken by Mr. Fordyce Grinnell at Pasadena, the other taken by me at North Island, Coronado, San Diego, June 30, 1913. The large size and hairy vestiture of this species will warrant its description from females only.

Holotype (No. 401), female, from Pasadena, in collection of the California Academy of Sciences.

Paratype in author's collection.

The following key will help to distinguish the six grey or fuscous mottled species having finely irrorate membranes, which have been reported from California:

Legs clothed with whitish hairs which are longer than the thickness of the tibiæ.................................*hirtus*, new species

Legs smooth or with minute pubescence only....................... 1

1. Dimorphus; male linear, uniformly grey, irrorate; female brachypterous with a fuscous ray on the clavus and wedge-shaped mark on the corium posteriorly.......................*canescens* Reut.

–. Sexes similar; above irregularly mottled.......................... 2

2. Head short, vertical, produced below the eye for a space equal to about one half the length of the eye.......................... 3

–. Head long, oblique, produced below the eye for a space nearly equal to the length of the eye 4

3. Smaller and pale; dextral margin of the male genital segment without a tooth superiorly ....*heidemanni* Reut.

–. Larger and darker; dextral margin of the male genital segment produced in a terete tooth superiorly ....*inops* Uhl.

4. Hind femora without an oblique pale annulus; second antennal segment one half longer than first; dextral margin of male genital segment produced in a broad flattened tooth superiorly........... ....*plenus*, new species.

–. Hind femora with an oblique subapical pale annulus; second antennal segment twice the length of first; dextral margin of male genital segment without a tooth at superior angle................ ....*fraterculus*, new species

15. **Phytocoris geniculatus**, new species

Pale greenish, sprinkled and varied with whitish; apex of cuneus and the hind femora tinged with fulvous, the latter armed at apex with two short black tubercules. Length 5 mm.

Head moderately produced, nearly vertical before; vertex and clypeus strongly convex leaving a deep suture between them, the vertex about one half wider than an eye in male, nearly twice as wide in female; frontal striæ conspicuous; cheeks prominent but scarcely angled before. Rostrum attaining third ventral segment; its first segment reaching the base of the head in male, a little longer in female. Antennæ longer than the entire body; first segment as long as head and pronotum together, linear, as thick as two-thirds the superior width of an eye, sparsely clothed with fine pale pubescence with a few longer stiff hairs intermixed; second segment nearly twice the length of first; third three-fourths the length of second; fourth one half of third. Pronotum strongly narrowed before, its length one half the basal width; sides straight; collum distinct; callosities large, obscure. Elytra somewhat polished all over, with two large areas more distinctly so. Legs long, the hind femora surpassing the membrane and much flattened. Apex of the male genital segment subacute; the sinistral notch deep and acutely angled, the margin rounded and unarmed above; sinistral hook short, crescentic, blunt at apex, not nearly reaching to the apex of the segment.

Color pale greenish or yellowish, marbled with whitish, the two polished areas of the elytra still whiter; apical half of cuneus and the hind femora tinged with fulvous; hind femora armed with a small deep-black tubercle on either side at apex. Whole upper surface sparsely clothed with a deciduous white pubescence with scattering longer fuscous hairs; the extreme tip of clavus with a minute tuft of black hairs, and in perfect examples there is another at the inner margin of the cuneus and probably a third at its inner basal angle. Legs and antennæ obscurely varied with pale fulvous-brown and whitish; the apex of the second and third antennal segments often infuscated as is the apical half of the fourth. Beneath, with coxæ and base of femora paler, the venter marbled more or less with darker. Membrane white, more or less irrorate with minute brown points and sometimes with a black point at the middle of the outer margin, the nervures yellowish.

Described from 32 examples, representing both sexes, taken at Coachella and Palm Springs, Calif., May 14th to 19th, 1917. At Coachella they were less mature and were found feeding on a small-leaved Atriplex. This species may be distinguished by its pale greenish white mottled aspect with a fulvous tinge to the cuneus and hind femora and by the two black tubercles at apex of these femora.

Holotype (No. 402), male, and allotype (No. 403), female, from Palm Springs, and paratypes in collection of the California Academy of Sciences.

16. **Phytocoris consors**, new species

Closely allied to *geniculatus;* differs principally in wanting the fulvous color on the cuneus and femora and the black tubercles on the apex of the hind femora and in having the basal segment of the antennæ distinctly white-pilose; pale dull greenish, evenly, finely marmorated with pale. Length 5 mm.

In its structural characters this species is almost identical with *geniculatus* but there are certain differences. The first antennal segment is much more thickly set with long stiff white hairs; the elytra do not show the contrasting polished areas which are quite evident in its ally and the tubercles at the apex of the hind femora are concolorous or barely tipped with black. the male genital characters seem scarcely to differ.

Here the color is the same greenish white found in *geniculatus* but the whole upper surface is quite uniformly marmorated with pale dull green. The pale polished areas found in the allied form and the fulvous tint so constant there are absent here. The antennæ have the same mottled aspect but none of the specimens before me show any trace of the fuscous apex on the second and third segments found in the other form. The membrane here is white with more or less of the fuscous dotting found in *geniculatus* and the whole upper surface is dotted with soft white hairs as in that species, but here I can detect in none of the specimens before me, all of which seem to be perfect, the longer stiff brown hairs present in the allied form.

Described from two male and five female specimens taken at Coachella and Palm Springs, Calif., May 14-21, 1917. Like the preceding they were found on the whitish vegetation growing on the floor of the desert.

Holotype (No. 404), male, and allotype (No. 405), female, and paratypes in collection of the California Academy of Sciences.

17. **Phytocoris ventralis**, new species

Nearest *geniculatus;* small, short and broad with much the aspect of a *Psallus*. White; elytra sparsely sprinkled with black; broad apex of the second antennal segment, knees, and a vitta on either side of the venter black. Length 4½ mm.

Head vertical, produced below the eye for a distance nearly equal to the length of the eye in the female, for about half this length in the male. Rostrum long, reaching to middle of venter in the female and to the sixth ventral segment in the male. Antennæ as long as the entire body in the male, a little shorter in the female; first segment short, stout, as long as the pronotum, clothed with soft white hairs which are nearly as long as the thickness of the segment; second segment as long as the corium; third two-thirds the length of second; fourth about equal to first. Pronotum short, rather steeply declinate; hind edge slightly emarginate; callosities large, not conspicuous; collum narrow, poorly distinguished. Elytra nearly parallel, opaque white with a subhyaline, more polished area exteriorly at

base and at apex. Abdomen reaching to tip of cuneus in the female. Legs short for this genus. Dextral male clasper very small; sinistral broad and angled superiorly at base, curved and lying against ventral margin of genital segment, the apex of which it attains, its apex subacute.

Color testaceous-white, clear white on the pronotum and elytra; upper surface clothed with short scale-like deciduous white hairs intermixed with which are a few strongly clavate black ones, imparting a sprinkled effect; apex of corium with a small fuscous cloud; apical margins of cuneus narrowly infuscated. Callosities testaceous like the head. Membrane minutely and irregularly irrorate with pale brown. Antennæ white; extreme tip of first segment fuscous; apex of second black for a space equal to one half the length of the first segment; third and fourth black; base of third narrowly white. Mesothorax beneath black with pale median and lateral vittæ. Venter with a broad deep-black vitta on either side attaining the genital segment in the female. Legs white, apex of femora, and extreme base of tibiæ more or less broadly black. A few small points on the tibiæ and the base and apex of the tarsi brown. Tibiæ clothed with soft white hairs and a few stiff brown bristles.

Described from one male and two female examples taken on palo-verde growing among the foothills seven miles west of Coachella, Calif., May 16, 1917. The male is immature with the black ventral vittæ scarcely indicated. The small eyes, oblong form, white color, black ventral vittæ and the presence of clavate black hairs above will distinguish this well-marked species.

Holotype (No. 406), female, allotype (No. 407), male, and paratype in collection of the California Academy of Sciences.

18. **Pallacocoris candidus**, new species

Aspect of a *Trigonotylus* nearly; creamy white throughout and clothed with a soft white pubescence, in fresh examples showing a median line of white hairs on the vertex, pronotum and scutellum; antennæ very long. Length 6 mm.

Head porrect; vertex nearly horizontal, viewed from above rounded before and projecting for a third of its length before the eyes; clypeus vertical, strongly convex, its basal suture deep, on a line with the insertion of the antennæ; cheeks prominent, cylindrical; gula horizontal; bucculæ low. Antennæ very long, one fourth longer than the entire body; first segment stout, linear, as long as the head and pronotum, a little thicker near its base, clothed above with soft appressed white hairs which become shorter at apex, and beneath with matted hairs longer than the thickness of the segment; second segment a little longer than the corium; third and fourth nearly equal to second. Rostrum reaching to near the middle of the venter, the first segment but little surpassing the base of the head. Pronotum trapezoidal, nearly horizontal, but little narrowed anteriorly; sides straight, carinated; collum broad, depressed, but poorly distinguished; callosities small, obscure, set far apart; hind margin truncate. Scutellum rather long; its basal field a little expanded. Elytra long, narrow, parallel. Legs long, hind femora surpassing the abdomen, narrowing from near base

to apex; hind tibiæ very slender, as long as the entire elytra. Basal segment of the tarsi longer than the second and equal to the third. Male genital characters inconspicuous, the dextral notch deep, the dextral clasper short, scarcely produced.

Color uniformly creamy white, sometimes tinged with green on the scutellum; antennæ infuscated at apex; apical margin of the elytra with three tufts of ferruginous hairs, one at tip of clavus and two on the inner margin of cuneus. In fully colored examples the membrane is tinged with ferruginous at apex and marked with two darker spots on the margin. Apex of tarsi a little darker. Rostrum black at apex. Base of the female oviduct infuscated.

Described from thirteen examples representing both sexes taken at Coachella and Palm Springs, Calif., May 16 to 23, 1917. This genus is certainly close to *Miridius* Reuter and is recognized here only in deference to Reuter's views. The species seems quite distinct from *suavis*. Generic characters are included in the above description for convenience.

Holotype (No. 408), male, and allotype (No. 409), female, and paratypes in collection of the California Academy of Sciences.

19. **Lygus abroniæ**, new species

Closely related to *rubicundus* Fall. as distinguished by Mr. Knight in his review of this genus. Larger, face clothed with long decumbent pale hairs; color bronze-grey to deep black; second antennal segment, tibiæ and tarsi pale except at base and apex, the femora always (?) black in mature examples; extreme tip of scutellum pale; membrane bivittate with fuscous. Length 5-6 mm.

Head more oblique than in *rubicundus*, moderately convex, distinctly punctate; basal carina and an oblique line from the hind angle of the eye half way to the middle, smooth; clothed with moderately long appressed grey hairs which converge obliquely to the median line; frontal striæ obvious but not conspicuous; clypeus prominent, smooth; bucculæ high, reaching to the basal third of the gula. Rostrum attaining middle of hind coxæ. Antennæ short as in *rubicundus;* first segment surpassing the clypeus by one half its length; second hardly three times the length of first, gradually thickened apically; third slender, sub-equal to first; fourth slender, about three fourths the length of third. Pronotum much as in *plagiatus*, more convex and sloping anteriorly than in *rubicundus;* closely evenly punctured; sides gently arcuated; callosities small, poorly defined; collum distinct; hind edge sinuated; sometimes a median smooth line is indicated. Scutellum about as in *plagiatus*, strongly, transversely rugose. Elytra closely, evenly punctured, the punctures coarser than in either of the allied species; embolium rather broad, becoming evanescent at middle of corium; cuneus moderately depressed as in *rubicundus*. Legs rather short as in *rubicundus*, the tibial spines black and shorter than the thickness of the member. Male genital segment produced on its ventral aspect, its apex rounded and pale; the claspers inconspicuous, formed much as in *rubicundus* but the sinistral shorter and blunter.

Color a bronzy grey-brown, much as in *plagiatus*, varying to deep black, when immature pale and tinged with green. In pale examples the collum is yellowish and the callosities black, sometimes sending an indistinct blackish ray either side the middle and another next the lateral margins. Scutellum in pale examples with a black geminate median vitta omitting the extreme tip which remains pale in the darkest individuals. Apex of corium with a blackish cloud which is more extended as the individual becomes darker. Extreme tip of clavus black. Cuneus always pale with the tip black; sometimes it becomes rosy red but this color does not seem dependent upon maturity. Membrane faintly enfumed with the nervures yellowish or even red; apex of the larger areole with a fuscous cloud which send a ray to the apex. These parallel rays are normally separated by double their own width but they may become extended so as to cover much of the surface. Antennæ black; second segment pale with its extreme base and apical one third black; narrow base of third segment pale. Femora black in mature examples, the anterior and intermediate pale when immature, more or less invaded with black; tibiæ and tarsi pale, the narrow base and apex of the tibiæ and apex of the tarsi black. Beneath black with a large ivory-white spot on the orificies; either side with a longitudinal pale vitta in pale examples which becomes nearly or quite obsolete in black specimens. Whole surface with a short pale pubescence which is easily rubbed off.

Described from four male and ten female examples taken from yellow sand verbenas (*Abronia latifolia*), growing on the sand dunes at Ingleside, San Francisco, March 24, 1918. A few nymphs and immature were taken with these adults. This species is perhaps nearest to *plagiatus* in many of its characters but its true relationship is with *rubicundus* from which its larger size, punctured hairy face, more convex pronotum, black femora and different coloration, especially of the membrane, will distinguish it. It pertains to Knight's *pratensis* group.

Holotype (No. 410), male, and allotype (No. 411), female, in collection of the California Academy of Sciences.

Paratypes in collection of the Academy and in that of the author.

20. **Pilophorus discretus**, new species

Allied to *walshi*, a little smaller and more constricted at the middle; fulvous-brown, elytra paler, the apical silvery line oblique but not dislocated, the polished outer half of the corium beyond this line abruptly fuscous. Length about 4 mm.

Head more produced than in *walshi*, its length before the eye distinctly more than the length of the eye, in *walshi* about the length of the eye; base of the vertex depressed, sharply, slenderly carinate behind. Basal segment of rostrum not exceeding the bucculæ. Pronotum polished; sides almost parallel anterior to the middle or a little constricted at the middle, the humeri angularly prominent; hind margin distinctly concavely arcu-

ated; anterior narrowly depressed imitating an obscure collum. Elytra parallel on basal half, much expanded posteriorly, the polished apical portion of the corium strongly marked and covering only the costal half beyond the second transverse line of silvery hairs; this line moderately oblique and not at all dislocated on the clavus as in *walshi*. Antennæ slender; first segment about as long as the eye; second nearly as long as the head and pronotum united, not obviously thicker at apex; third about one third the length of second.

Color reddish or brownish fulvous, becoming pale on the elytra; disk of the vertex and pronotum shading darker; extreme apex of the clavus and polished area at apex of the corium fuscous. Scutellum and elytra with the usual lines of deciduous silvery hairs; the basal line on the corium short, the apical retreating somewhat at the costa and continuous on the clavus. Cuneus fuscous with an oblique line of silvery hairs from near the inner angle well toward the costa along the basal suture. Membrane dark with a large smoky cloud. Beneath bright fulvous with the abdomen piceous. Legs fulvous, the hind pair infuscated. Antennæ reddish brown, pale at base; (fourth segment wanting).

Described from two female examples; one taken at Colton, Calif., May 28, 1917, the other from Alpine, San Diego County, taken October 3, 1913. This is a small, clearly marked species which may be distinguished by the slender antennæ, long head, short basal segment of the antennæ and bicolored apex of the corium.

Holotype (No. 412), female, from Colton, in collection of the California Academy of Sciences.

Paratype, in collection of the author.

21. **Pilophorus tomentosus**, new species

Form of *clavatus;* dull cinnamon brown, rather densely clothed with soft pale hairs; posterior silvery line not dislocated on the clavus. Length $4\frac{1}{2}$ mm.

Head long, produced below the eye considerably more than the length of the eye; base of the vertex but feebly depressed, the hind edge sharp but scarcely carinated. First antennal segment barely attaining the apex of the head; second as long as the head, pronotum and scutellum together, moderately thickened at apex; third and fourth together three fourths the length of second; fourth one half longer than third. Pronotum parallel on anterior two thirds, then abruptly flaring to the humeri. Rostrum reaching the tip of the hind coxæ; first segment just surpassing the bucculæ. Elytra a little narrower than in *clavatus;* moderately expanded at apex; posterior line of silvery hairs a little oblique but not dislocated at the clavus. Apical field of corium obscurely polished on costal half only.

Color a dull cinnamon brown, sometimes a little clearer on base of the elytra and beneath, more or less tinged with red on the head, pronotum and antennæ. Apical portion of second and third antennal segments fuscous, the fourth whitish, infuscated at apex. Scutellum with the usual lateral and apical lines of silvery hairs. Posterior silvery line of the elytra a little advanced at the commissure, not dislocated at claval suture. Pol-

ished apical area of the corium a very little darker. Basal submargin of the cuneus with a cuneiform line of longer silvery hairs. Membrane obscure with a fuscous median cloud. Venter with an oblique area of silvery hairs on either side.

Described from three male and fourteen female examples taken on willows at San Juan Capistrano, Calif., June 24, 1914. The dull brownish color and pubescent surface will distinguish this species.

Holotype and allotype in author's collection.

Paratypes in collection of the California Academy of Sciences and in that of the author.

22. **Pilophorus tibialis**, new species

Allied to *clavatus* and still more closely to *cinnamopterus*. Second antennal segment gradually much thickened toward its apex, third fuscous, fourth mostly white; posterior silvery line on the elytra entire; hind tibiæ flattened and curved; membrane with a fuscous area overrunning the areoles; apex of the corium polished across its whole width. Length 5 mm.

Head shaped as in *clavatus* but somewhat broader at base; viewed from before narrower and more pointed than in *amœnus;* viewed from the side more depressed and subcarinate below the eye, the apex surpassing the eye by considerably more than the length of the eye; vertex deeply impressed either side, the median line sometimes broadly, slightly carinate, not at all sulcate; the hind margin more strongly elevated than in either allied species; cheeks pointed at apex, almost attaining the tip of the clypeus, their sides feebly arquated. Antennæ about as in *amœnus;* the first segment shorter and the third distinctly longer than in that species; second longer and more clavate than in *clavatus,* about as in *amœnus;* fourth segment a little shorter than third and about equal to first. Rostrum attaining tip of intermediate coxæ, the basal segment reaching hardly more than half way to the anterior angle of the eye. Pronotum about as in *clavatus,* shorter and more finely rastrate than in *amœnus,* distinctly impressed between the callosities. Elytra about as in *amœnus,* the posterior silvery line often a little sinuated but not dislocated at claval suture; corium beyond this line polished across its whole width. Hind legs longer than in *clavatus,* about as in *amœnus* but with their tibiæ still broader and more curved in both sexes, its width at the basal third nearly equal to the width of the femora. Sinistral male clasper transverse, longer than broad, its apex abruptly armed with a small acute, incurved tooth. In *amœnus* this clasper is more quadrangular with its apical hook scarcely more than an acute tubercle while in *clavatus* this clasper is lunate with its apex flattened and even broader than the base.

Color piceous-black, the elytra before the posterior silvery line dark cinnamon brown; head, anterior portion of pronotum and beneath more or less tinged with cinnamon; the anterior and intermediate tibiæ, at least at apex, paler; base of the vertex and clypeus infuscated in pale examples. Antennæ pale brown or tinged with castaneous, the clavate portion of the

second segment piceous; third infuscated, paler at base; fourth white, minutely tipped with fuscous. Rostrum pale piceous. Posterior line of silvery hairs on the elytra usually a little sinuated, not at all dislocated at claval suture. Apex of clavus, corium behind the silvery line for its whole width and the cuneus moderately polished and infuscated. Membrane infuscated, with a deeper blackish cloud covering the larger areole and adjoining surface posteriorly. Raised disk of the scutellum bounded by the usual lines of silvery hairs at each side and at the apex. Base of the hind tarsi and often of the tibiæ paler brown.

Described from 32 examples, representing both sexes, taken on coniferous trees at Cayton in eastern Shasta County, Calif., and at Sisson, Calif., July 15 to 27, 1918. These were much more abundant on pines but were also taken on firs and cedars. This species may be distinguished by the prominent base of the vertex, the broad, curved hind tibiæ, and the fuscous third and white fourth antennal segments. I have specimens from Manitou, Colo., that do not differ from this species and Mr. W. M. Giffard has taken it at Donner Lake, Placer County, Calif., at an elevation of 6000 feet. It is probably the common species on pines throughout California.

Holotype (No. 413), male, and allotype (No. 414), female, from Cayton, and paratypes in collection of the California Academy of Sciences.

23. **Pilophorus crassipes**, new species

Allied to *tibialis* but with narrower hind tibiæ; vertex with a median sulcus; membrane with a blackish lunule behind the areoles; length 6 mm.

Head broad triangular and flattened much as in *tibialis*. Base of the vertex much depressed; hind margin strongly elevated; median line sulcate; front of vertex with evident striæ; apex of the cheeks narrowly truncate, considerably exceeded by the clypeus; sides of the head bluntly carinate before the eye as in the allied species. Second antennal segment rather thicker than in either *amœnus* or *tibialis*, becoming less abruptly narrowed toward the base, thus giving the antennæ a heavier look; third segment nearly twice the length of first and almost as thick; fourth three fourths the length of third and more slender. Rostrum attaining the hind coxæ; the basal segment much surpassing the bucculæ but not reaching the base of the head. Pronotum broader than in *tibialis* and *amœnus;* as wide as the head across the eyes; disk posteriorly strongly rugose-shagreened. Posterior line of silvery hairs on elytra entire, not dislocated at claval suture; the surface of the clavus and corium behind this line and the cuneus polished. Hind tibiæ long, flattened and curved but not so strongly as in *tibialis*, its greatest width about half that of the femora. Upper surface, of the elytra at least, clothed with scattering short erect stiff fuscous hairs.

Color piceous-black, becoming more brownish on head and antennæ, the thickened apical portion of the second segment shading to darker piceous; fourth segment white with only the tip dusky. Lines of silvery hairs on the scutellum and elytra more slender than in the allied forms, the posterior straight and entire, not dislocated on claval suture. Membrane paler than in the allied forms, with a broad fuscous lunule at apex of the larger areole.

Described from a male from Glen Echo, Md., July 20, a female from Washington, D. C., June 15, both taken by the late Otto Heidemann and determined by him as "*Pilophorus crassipes* Uhl. MS.", and a female taken by myself at Riverton, N. J., August 17, 1902. Most of my material in both this species and the next, including specimens determined by Dr. Uhler, was sent to Dr. Reuter for study but a short time before his death and has never found its way back to me. These species however are very distinct and can safely be described from scant material. Both were listed by Heidemann in 1892 (Proc. Ent. Soc. Wash., ii, p. 225), but his comparative notes do not form a proper description of the species. *P. crassipes* is common on pine throughout the east.

Holotype, female, from Wash., D. C., and allotype, male, from Glen Echo, in collection of the author. Paratype in collection of the California Academy of Sciences.

24. **Pilophorus lætus**, new species

Size and aspect of *discretus* but very distinct from all our other species by the abruptly clavate second antennal segment. Length 3½ mm.

Head large; viewed from before broadly rounded at apex with the narrow pointed clypeus projecting a little below the cheeks. Face convex; vertex with a median sulcus, scarcely depressed at base, the hind edge very slenderly carinate. Sides of the head strongly, obtusely carinate beyond the eyes. Antennæ slender; the apical one third of second segment abruptly, strongly clavate. Rostrum reaching the hind coxæ, the first segment hardly attaining the base of the head. Pronotum short, sides parallel anteriorly, the humeri angularly produced but not wider than the head across the eyes. Elytra much expanded at apex; anterior silvery line oblique, posterior interrupted from the cubital vein almost to the claval suture, not dislocated on clavus; Apex of the clavus and corium beyond this line for their whole width and the cuneus polished, the latter with a silvery point at its inner angle.

Color piceous or more or less castaneous, becoming paler on the head antennæ and legs. Club of second antennal segment piceous, preceded by a paler space; third segment white, fuscous at tip, (fourth segment wanting). Base of elytra bright cinnamon as in *amœnus*. Membrane a little

fuliginous with a large fuscous cloud centered at the apex of the areoles. Base of the anterior coxæ, much of the posterior, and base of the tarsi whitish.

Described from one female example collected by Mr. Otto Heidemann at Rock Creek, D. C., June 20, 1890, and determined by him as "*Pilophorus lætus* Uhl." I took one male at Washington, D. C., June 25, 1905, and a female at Woodbine, N. J., August 21, 1902, but both are now too imperfect to be used as types.

Holotype in collection of the author.

The following key will distinguish our recorded North American species of Pilophorus:

Third antennal segment with the apical one third abruptly clavate; posterior silvery line interrupted on the corium, not dislocated at claval suture; length 3½ mm. .... *lætus*, new species
Third antennal segment gradually thickened toward the apex or nearly linear 1
1. Third antennal segment linear or practically so; posterior silvery line entire, a little oblique; length 4 mm..... *discretus*, new species
–. Third antennal segment obviously thicker at apex 2
2. Third antennal segment but little thickened at apex 3
–. Third antennal segment much thickened at apex, clavate; apex of elytra smooth; length 5 to 6 mm. 6
3. Surface clothed with rather long appressed grey hairs 4
–. Surface smooth or with scattering stiff hairs; apex of corium polished exterior to cubital vein only; posterior silvery line dislocated 5
4. Apex of corium polished across its whole width; posterior silvery line dislocated at the clavus .... *schwarzi* Reut.
–. Apex of corium polished exterior to cubital vein only; posterior silvery line entire .... *tomentosus*, new species
5. Length about 3½ mm.; basal segment of rostrum scarcely surpassing the bucculæ; base of fourth antennal segment broadly pale .... *walshi* Uhl.
–. Length 5 mm.; basal segment of rostrum nearly attaining base of head; base of fourth antennal segment very narrowly pale .... *clavatus* Linn.
6. Elytra comparatively broad, but little widened apically; hind tibiæ normal; fourth antennal segment white with apex black .... *cinnamopterus* Kb.
–. Elytra more expanded apically; hind tibiæ flattened and more or less curved 7
7. Third antennal segment white; base of vertex scarcely elevated, its median line sulcate .... *amœnus* Uhl.
–. Third antennal segment fuscous or black 8
8. Base of vertex sulcate; membrane with a blackish lunule at apex of the areoles; elytra clothed with short, stiff, erect hairs .... *crassipes*, new species
–. Base of vertex not sulcate; membrane with a large blackish cloud covering the larger areole and invading the surface beyond; elytra smooth .... *tibialis*, new species

25. **Lopidea occidentalis**, new species

Closely allied to *media* Say and apparently the western representative of that species; above sanguineous, scutellum, callosities, antennæ and markings on the head black; right clasper of male without subapical tooth. Length 5½ mm.

Structural characters very near to those of *media*. Vertex a little fuller and more convex. Antennæ shorter, as long as from apex of head to base of cuneus. Dextral clasper of male broad, strap-shaped as in *media* but without the subapical tooth, the basal tooth shorter, more slender and incurved from near its base, just attaining the base of the dorsal tooth of the pygofer; this median dorsal tooth on the pygofer is much larger in the present species, surpassing the anal tube, slender and hooked at apex. Sinistral clasper elongate-triangular, acute at superior apical angle; fringed ventrally with long pale hairs. In *media* the dextral clasper is armed with a produced tooth before its apex dorsally; the basal tooth is very long, curved, and fully equals the dorsal tooth of the pygofer; this dorsal tooth much shorter and armed with an apical hook; the sinistral clasper, also, is bilobed, both lobes being broadly rounded at apex.

Color sanguineous as in *media*; clypeus, two longitudinal areas on the vertex and its base black, these markings sometimes extended so as to cover most of the surface. Callosities black, contiguous. Scutellum black tinged with red at apex. Clavus and inner field of corium more or less infuscated, darker in the male. Membrane blackish, iridescent, the nervures black. Antennæ and legs black or nearly so, the femora invaded with pale at apex. Sternum and middle of venter more or less clouded with black, the male genitalia red. Rostrum piceous, reaching the hind coxæ.

Described from 39 specimens, representing both sexes, taken at Palm Springs, Calif., May 19, 1917, on *Croton californicus,* found growing near the mouth of Andreas' Canyon. The male genital characters and shorter antennæ will distinguish this species from its eastern ally. The general color, also, is deeper, more as in *reuteri* and *cæsar.*

Holotype (No. 415), male, allotype (No. 416), female, and paratypes in collection of the California Academy of Sciences.

26. **Hadronema infans**, new species

Small, black; posterior lobe of pronotum and elytra dull sanguineous; inner field of corium obscured, the membrane black; length 3½-4 mm.

Head as in *picta*, the basal impression of the vertex deep; antennæ short, as long as from apex of head to base of cuneus. Basal lobe of scutellum covered by the pronotum, the apical lobe convex, without a basal depression. Rostrum attaining the apex of hind coxæ; tip of venter reaching to apex of the cuneus. Male genital characters distinctive. Dextral clasper elongate-conical, curved and almost hooked at apex which passes just above

the apex of the sinistral clasper; this sinistral clasper convex, ligulate, rounded at tip and incurved against the apex of the genital segment; both claspers with a few long stiff hairs ventrally.

Color black, more or less covered with a white bloom, especially on the head and pronotum; head obscurely marked with pale next the eyes and on the cheeks. Posterior lobe of pronotum and elytra obscure sanguineous, paler on the humeri and base of the corium; the clavus and inner field of the corium obscured or blackish. Scutellum blackish; membrane black; sides of venter more or less tinged with reddish. Upper surface sparsely clothed with very short appressed pale hairs.

Described from 69 examples taken at Palm Springs, Calif., May 22, 1917, on *Dalea emoryi* found growing on the floor of the desert a mile or two east of town. This species is nearest *picta* in size and genital characters but is very distinct from any previously described species.

Holotype (No. 417), male, allotype (No. 418), female, and paratypes in collection of California Academy of Sciences.

27. **Hadronema albescens**, new species

Allied to *decorata* Uhl.; white or almost lead-color; head, base of antennæ, scutellum and femora fulvous; inner angle of corium with a blackish spot; length 4 mm.

Head about as in *militaris*, the vertex flatter than in *robusta*. Rostrum attaining the middle of intermediate coxæ, its first segment scarcely surpassing the base of the head. Antennæ about as in *robusta*; second and third segments equal in length; first and fourth subequal, the first thickened and fusiform. Pronotum rather less roughened than in the allied species, the callosities large but not prominent; anterior margin showing a flat membranous expansion covering the base of the head but this cannot properly be designated as a collum and becomes a mere margin in the allied forms; carinate lateral margins obtuse; humeral angles rather prominent. Scutellum flattened. Elytra parallel; costal margin sharply distinguished and narrowly foliaceous; cuneus unusually long and narrow. Upper surface of the pronotum, scutellum, clavus, and disk of the corium clothed with scattering stiff fuscous hairs springing from fuscous dots; sides of corium and cuneus with a softer white pubescence. Legs long, the tibiæ armed with long stiff black bristles, much longer than the thickness of the member. Male genital characters obscure. Dextral clasper broad, flat, bent in its own plane at about the middle and truncate at apex; sinistral clasper produced in a long acute black spine.

Color white or somewhat lead-color; head, scutellum and coxæ of a pale dull fulvous, the borders of the eyes, cheeks, loræ and bucculæ white; basal segment of the antennæ and femora of a deeper fulvous. Antennæ, except basal segment, rostrum, tibiæ and tarsi black; the base of the second antennal segment, of the rostrum and of the tibiæ paler or fulvous; pronotum, venter, clavus and disk of the corium more or less darkened or lead-color and punctured with fuscous at base of the black hairs. Inner angle of corium with a transverse blackish spot not passing the radial vein. Membrane white, somewhat infuscated in the areoles, the veins blackish. Hind femora and pygofer of the female blackish at base.

Described from 80 examples representing both sexes, taken on *Dalea emoryi* at Palm Springs, Calif., May 18-22, 1917. A few examples were also captured on a species of Atriplex where they probably were resting. This is identical with the "immature variety" (No. 777) mentioned by Dr. Uhler in his description of *Hadronema decorata* but it is a very distinct species. It is still nearer *H. splendida* Gibson (Can. Ent., 1, p. 84, 1918) but is sufficiently distinct.

Holotype (No. 419), male, allotype (No. 420), female, and paratypes in collection of the California Academy of Sciences.

28. **Orthotylus hamatus**, new species

Form and size of *languidus* nearly; clear light green; membrane uniformly whitish hyaline; length 6 mm.

Elongate oval, rather broad, nearly smooth, clothed only with very minute pale pubescence. Vertex flattened across the base in the male, scarcely so in the female, the basal carina sharp. Front moderately convex, less so in the male; characters of the head about as in *languidus*; clypeus prominent; antennæ short; second segment distinctly shorter than in *languidus*, hardly longer than the basal width of the pronotum. Pronotum about as in *languidus*, its length one half its basal width; sides straight; callosities large, oval, widely separated; hind margin concavely arcuated. Elytral costa slightly arcuated. Apex of abdomen reaching to middle of cuneus in the male, to its apex in the female. Rostrum attaining the posterior margin of the metasternum; first segment slightly surpassing the base of the head. Dextral clasper of male broad, strap-shaped, truncate at its incurved apex, its base broadly extended dorsally and armed with a sharp curved hook which is parallel to and about half as long as the broad ventral portion. Sinistral clasper linear, subterete, attaining the apex of the ventral plate of the genital segment. This genital conformation is very nearly as in *languidus* with the addition of the sharp parallel dorsal hook added to the dextral clasper.

Color a pale clear bluish green deepened along the clavale suture; head and breast sometimes paler; membrane whitish hyaline, very slightly infuscated in the male, the apical margin slenderly darker. Eyes and tip of the tarsi and rostrum black. Antennæ tinged with yellow and somewhat infuscated at apex.

Described from three male and seven female examples taken on willows growing by the river above Colton, Calif., May 28, 1917, and one female taken at Soboba Springs near San Jacinto, Calif., June 2, 1917.

This species may be distinguished from *languidus* by its more pronounced green color, the darker line along the claval suture, the uniformly hyaline membrane and especially by the want of

the conspicuous long pale hairs clothing the upper surface of that species.

Holotype (No. 421), male, allotype (No. 422), female, and paratypes in collection of the California Academy of Sciences.

29. **Orthotylus albocostatus**, new species

Aspect of *uniformis;* closely allied to *fraternus* but larger and broader with the costal margin of the elytra quite broadly whitish; length 5-5½ mm.

Head about as in *uniformis,* longer and more oblique than in *fraternus;* length below the eye distinctly greater than the greatest length of the eye; clypeus very prominent and convex; vertex but little flattened, the carina feeble. Pronotum short, transverse; humeri prominent, flattened; sides sharply carinate; callosities but little elevated, in the female distinguished by a transverse depression. Elytra long, the costa feebly arcuated in the male, more strongly in the female; cuneus in the male much elongated, Rostrum reaching the apex of the intermediate coxæ. Antennæ about as in *fraternus;* first segment thicker, armed within near the apex with two or three stiff fuscous hairs which are longer than the thickness of the segment; second segment distinctly longer than the basal width of the pronotum; third nearly equal to second; fourth hardly longer than first. Surface clothed with soft white hairs which become scale-like and conspicuous on the pronotum and head and are intermixed with stiffer fuscous ones on the elytra interior to the radial vein. Male genitalia small; dextral clasper nearly circular, pedicellate; sinistral scarcely twice the size of the dextral, transverse or a little oblique.

Color pale dull green, becoming still paler on the head and pronotum and darker on the clavus. Pronotum and scutellum with an obscurely paler median line; costal margin to the radial vein whitish hyaline, this pale margin fading out on the cuneus. Membrane moderately infuscated, paler in the areoles, the veins pale or green. Antennæ green at base becoming infuscated at apex. Tip of rostrum, apex of tarsi and tibial bristles black.

Described from twelve male and nine female examples taken at Keen Camp, San Jacinto Mountains, Calif., June 12, 1917, on a species of Gilia with slender foliage, and one male taken in Muir Woods, Marin county, Calif., May 19, 1915. This form may be distinguished among our green species by its long head, the pale costal margin and the fact that the brown hairs on the elytra are found only on the surface interior to the radial vein.

Holotype (No. 423), male, and allotype (No. 424), female, from Keen Camp in collection of the California Academy of Sciences.

Paratypes in the collection of the Academy and in that of the author.

30. **Parthenicus covilleæ**, new species

Aspect of *picicollis* but paler; fulvous yellow with uniformly black membrane; length 3-4 mm.

Head somewhat less produced than in *picicollis*, the extension below the eye rather less than the greatest width of the eye; clypeus prominent with a deep depression between its base and the apex of the front. Antennæ similar to those of *picicollis;* first segment thickened, scarcely surpassing the apex of the head; second subequal to third and fourth united. Elytral costa very slightly arcuated. Upper surface clothed with long stiff concolorous or pale hairs becoming blackish on the disk of the elytra and somewhat matted about the apex of the clavus giving that place a blackish aspect in perfect examples. Male claspers small, rounded when viewed from the side; the dextral subacute and oblique; the sinistral produced along the ventral wall of the segment to its apex.

Color a soiled yellowish fulvous, more or less tinged with red, in fully colored examples showing a transverse band covering the scutellum, base of the elytra and the cuneus, reddish. Membrane uniformly deep fuscous, the nervures red; sometimes there is a small paler lunule at the apex of the cuneus. Legs and antennæ paler, the basal segment of the latter more reddish. Tarsal claws black. Abdomen of the male sometimes tinged with green.

Described from 27 examples, representing both sexes, taken on creasote bush, *Covillea mexicana,* at Palm Springs and Coachella, Calif., May 18-21, 1917, where it was abundant and just reaching maturity. The uniformly yellowish color and blackish membrane will distinguish this species. Only the most fully colored individuals show indications of sanguineous irrorations in the reddish areas on the base of the elytra and cuneus.

Holotype (No. 425), male from Palm Springs, allotype (No. 426), female from Coachella, and paratypes in collection of the California Academy of Sciences.

31. **Parthenicus candidus**, new species

Closely allied to *vaccini,* the femora wanting the fuscous dotting but marked with a few black points; white, dotted with black; base of scutellum and thickened vein at base of membrane sanguineous; membrane white with two marginal spots and a few discal points brown; length 3-3½ mm.

Male: Head short, vertical; produced below the eye for less than the width of the eye; clypeus prominent; its basal incisure distinct. Antennæ as in *vaccini;* first segment but little surpassing the apex of the head, thicker, armed near the apex with two black bristles set in black dots; second as long as basal width of pronotum; third two thirds the length of second; fourth hardly longer than basal. Rostrum attaining the middle of the venter, the first segment passing the middle of the anterior coxæ.

Pronotum a little broader with the sides more oblique than in *vaccini;* more strongly depressed anteriorly, the callosities obscure. Basal lobe of scutellum somewhat exposed, Elytral costa feebly arcuated. Claspers similar to those of *vaccini*. Sinistral narrow, lying along the ventral wall of the segment and reaching to its middle line. Dextral terete, slender, curved and overlapping the sinistral a little. In all specimens before me this clasper is lifted free from the margin and this may be its normal position.

Color a dead white becoming soiled or testaceous on the head and anterior lobe of pronotum; surface of pronotum minutely dotted with brown omitting its posterior disk. Basal lobe of scutellum clouded with sanguineous which color may invade the base of the posterior lobe. Elytra dotted with black, these dots arranged somewhat in lines, two rows of seven each on the clavus being quite regular; those of the corium paler and more confused, towards the apex carrying brown hairs. Apex of the clavus with a pencil of black hairs and there are three similar clusters on the cuneus, one at its basal angle and two beyond the middle of the inner margin. Thickened vein at base of the membrane sanguineous. Membrane clear white with two fuscous clouds on the apical margin and a few faint brown points on the disk, the veins white. Antennæ with a black point near the apex of the first segment and three or four fainter dots on the second, sometimes obsolete. Femora with a few black points, one near the apex of the hind pair being larger. Tibiæ strongly dotted.

Female sometimes brachypterous, then ovate with a shorter pronotum and a soiled white color, more strongly spotted and wanting the sanguineous marks. The macropterous female similar to the male.

Described from three male and three female examples taken on *Hymenoclea salsola* at Coachella, Calif., May 16, 1917, and at Palm Springs, May 21, 1917. This species is very close to *vaccini* from Massachusetts but the difference in the food-plant and locality in addition to color characters would seem to warrant its separation; *vaccini* has the femora infuscated or irrorate at apex and the disk of the pronotum and scutellum evenly dotted; it also wants the sanguineous markings and has the dotting of the elytra confined to the corium and fainter and more irregular, and the disk of the membrane without brown points. Both have the pale hairy vestiture.

Holotype (No. 427), male, allotype (No. 428), female, and paratypes in collection of the California Academy of Sciences.

Our eight species of *Parthenicus* may be distinguished by the following key:

Color, including the membrane, white.............................. 1

Color pale, usually irrorate with sanguineous or mostly sanguineous; membrane fuscous or mostly so 2

1\. Femora irrorate with fuscous at apex; elytral dots omitting the clavus; disk of pronotum and scutellum dotted; no red markings, eastern, on Vaccinum............................*vaccini* V. D.

–. Femora with a few black points; clavus with two rows of black points; disk of pronotum and scutellum free from points; base of scutellum and basal vein of membrane sanguineous, western, on Hymenoclea ....*candidus*, new species

2. Membrane fuscous with two pale marginal spots beyond the cuneus. 3

–. Membrane uniformly fuscous 4

3. Tibiæ minutely dotted with sanguineous; inner angle of elytra infuscated, the surface minutely dotted with sanguineous; membrane faintly enfumed ....*psalloides* Reut.

–. Tibiæ coarsely dotted with fusco-sanguineous; elytra uniformly more coarsely dotted with sanguineous or washed with that color; membrane deeply enfumed, the paler spots contrasted..*ruber* V. D.

4. General color white or pale salmon with a sanguineous band crossing the scutellum and base of elytra; without sanguineous irrorations; hind femora fusco-sanguineous..............*giffardi* V. D.

–. General color croceus or testaceous, usually irrorate with sanguineous or mostly sanguineous.................................... 5

5. Pronotum and scutellum piceous-brown; elytra sanguineous or heavily irrorate with that color..................*picicollis* V. D.

–. Pronotum and scutellum not colored differently from elytra........ 6

6. Testaceous, irrorate with sanguineous; femora heavily irrorate, ...*soror* V. D.

–. Croceus, without irrorations; base of elytra and cuneus sometimes sanguineous; femora concolorous...........*covilleæ*, new species

32. **Psallus croceus**, new species

Aspect of *seriatus* but more brightly colored; whitish, thickly sprinkled with bright croceus; membrane irrorate; length 3-3½ mm.

Head short, projecting below the eye for a distance equal to the greatest width of the eye; clypeus broad, poorly distinguished. Antennæ normal for the genus; first segment scarcely surpassing the apex of the head; second nearly equal to the basal width of the pronotum; third and fourth together not longer than second; third one fourth longer than the fourth. Pronotum short and broad, but slightly declinate; its length two-fifths its basal width; sides feebly arcuate; hind margin a little concavely arcuate; callosities small. Basal lobe of scutellum exposed; costal margin of elytra feebly arcuated. Hind femora broad, flattened. Dextral male clasper long, curved and tapering, transverse, reaching across the genital segment; sinistral porrect, triangular, flattened, but little shorter than the dextral.

Color testaceous-white; upper surface closely sprinkled with rather large orange dots, the disk of the cuneus quite strongly tinged with orange. Membrane whitish hyaline, sparsely sprinkled with pale fuscous dots; veins and a large spot at apex of cuneus white, the latter bordered behind by a fuscous cloud; areoles infuscated about their margins, shading to hyaline on their basal disk; hind femora usually with a few dusky dots, about three of which are larger and persistent. Tibiæ armed with a few stout bristles, posterior with a row of large black dots; the anterior and intermediate with a few small dots toward their base. Base of the female oviduct sometimes infuscated. Upper surface clothed with stiff somewhat appressed pale hairs.

Described from six male and eight female examples taken on a sycamore tree in Andreas' Canyon at Palm Springs, Calif.,

May 19, 1917. The coarse orange dotting of this species will serve to distinguish it.

Holotype (No. 429), male, allotype (No. 430), female, and paratypes in collection of the California Academy of Sciences.

33. **Atomoscelis peregrinus**, new species

Color and aspect of *Sthenarus cuneotinctus* but aside from generic characters it may be distinguished by its larger size and uniformly pale antennæ and legs; pale greenish with red cuneus; length 3½ mm.

Head short, broad, vertical; clypeus prominent, abruptly bent so the apex is inferior and almost horizontal; its base on the line connecting the antennæ, the suture distinct; apex of head forming a right-angle; gula wanting; vertex broad, moderately convex, ecarinate at base. Antennæ reaching nearly to tip of clavus; basal segment thick, not surpassing apex of head; second as long as the pronotum and half the scutellum, two fifths the basal width of the pronotum. Rostrum a little surpassing the hind coxæ in female, attaining the fifth ventral segment in male. Pronotum short, trapezoidal, sides strongly oblique; callosities small, distinct; base of scutellum covered. Elytra parallel or nearly so. Hind femora saltatorial, broadly flattened. Surface above clothed with minute deciduous scale-like white hairs. Male claspers large, broad, plate-like; the dextral nearly a parallelogram with its apex oblique and produced above; sinistral transverse with its dorsal and ventral angles subacute.

Color pale yellowish becoming greenish on the elytra and abdomen or at times altogether greenish; cuneus red; tarsi tipped with black, the legs otherwise immaculate.

Described from two male and thirty-one female examples taken on *Dalea schottii* at Coachella, Calif., May 16, 1917. At Palm Springs it was also taken in numbers, with its young, on this Dalea and on *Krameria canescens.*

Holotype (No. 431), male, allotype (No. 432), female, from Coachella, and paratypes in collection of the California Academy of Sciences.

34. **Tuponia lucida**, new species

Pale tender green with subhyaline elytra; hind tibiæ dotted with black; length about 4 mm.

Head short, vertical, somewhat produced, the facial angle being a little less than a right angle; produced below the eye for almost the length of the eye. Vertex broad, quite convex, ecarinate at base. Clypeus broad, flat at base with the basal suture nearly obsolete; rounded and prominent

at apex; gula scarcely indicated. Rostrum reaching hind coxæ; first segment attaining base of head. Basal segment of antennæ scarcely surpassing apex of head; second almost as long as basal width of pronotum, a little longer than third and fourth together; fourth two thirds of third. Pronotum short, transverse; its length two fifths its basal width, the sides a little rounding to the anterior angles; callosities narrow, well defined. Elytral costa very slightly arcuated. Dextral male clasper elongated, obtuse, about four times wider than long, just passing the middle of the genital segment; sinistral porrect, triangular, transversely convex.

Color pale or whitish green, sometimes tinged with yellow on the head; the elytra subhyaline. Membrane whitish hyaline, highly iridescent; veins pale green. Antennæ slightly infuscated at apex. Tibiæ dotted with black, these dots on the anterior and intermediate very small; apex of tarsi black. Upper surface clothed with soft white hairs.

Described from one male and seven female examples taken on willows along the Tahquitz trail in the village of Palm Springs, Calif., May 21, 1917. This form may be distinguished by its uniform pale green color and spotted tibiæ. Its longer head and uniform coloring will distinguish it from our other species of Tuponia.

Holotype (No. 433), male, allotype (No. 434), female, and paratypes in collection of the California Academy of Sciences.

35. **Tuponia dubiosa**, new species

Very close to *lucida;* smaller, proportionately broader and more deeply colored; light green, membrane immaculate; hind femora broader and more distinctly dotted, the tibial dots smaller; length 3 mm.

Characters of head about as in *lucida* but with the vertex obviously narrower; basal segment of rostrum not passing the base of the head; hind femora broader than in *lucida*, subovate.

Color more distinctly green than in *lucida*, more tinged with soiled fulvous on the head and beneath, especially on hind femora and sides of abdomen. Femora minutely but distinctly dotted with brown, the dots on the anterior and intermediate sometimes almost obsolete; tibiæ white, the tibial spines pale, springing from minute black points which are much smaller than in *lucida*. Membrane whitish hyaline, immaculate or apparently so. Upper surface clothed with soft white hairs. Base of oviduct infuscated.

Described from six female examples taken on palo verde at Coachella, Calif., May 16, 1917. Although very close to *lucida* this form seems to be distinct by its smaller size, less elongated form, deeper color, immaculate membrane and nearly impunctate tibiæ.

Holotype (No. 435), female, and paratypes in collection of California Academy of Sciences.

36. **Plagiognathus pictipes**, new species

Above pale greenish becoming yellowish on the head; beneath and legs piceous or almost castaneous, somewhat irrorate with pale; abdomen green; length 3 mm.

Head narrower than in *Europiella stigmosa*, but little more than half the basal width of the pronotum, vertical before, the face scarcely inferior as in Europiella; clypeus but little prominent, the basal suture distinct but not deep, a little above the insertion of the antennæ; facial angle rather less than a right angle; gula none. Rostrum attaining the base of the intermediate coxæ; basal segment dilated, just passing the base of the head. Antennæ short; first segment hardly attaining apex of clypeus; second as long as the width of head across the eyes; third two thirds the length of second; *fourth two thirds of third.* Pronotum but little declinate anteriorly, the callosities obvious but not prominent; basal lobe of scutellum covered. Costal margin of elytra but feebly arcuated; the abdomen of the female reaching half way from tip of cuneus to apex of membrane. Hind femora broad, compressed; hind tarsi with the third segment scarcely longer than second. Characters of male claspers obscure, the sinistral small, transverse.

Color above pale greenish or whitish, becoming yellowish or even fulvous on the head; beneath clear pale green marked with fuscous or dark castaneous on lower surface of head and on the breast. Legs whitish, coarsely, irregularly dotted with blackish castaneous, at times becoming almost entirely black, especially on the hind femora; all the tibiæ white with white spines springing from small black points; tarsal claws black; oviduct of female sometimes infuscated. Apex of the antennæ infuscated, the basal segment more or less marked with castaneous. Elytra immaculate greenish. Membrane whitish hyaline, faintly irrorate with dusky, nervures pale. Wings whitish hyaline, highly iridescent.

Described from one male and nine female examples taken at Coachella, Calif., near the railway station, May 13, 1916. The single male is immature indicating that as in *decolor* the male appears later than the female. This species like *decolor* has the aspect and general characters of Europiella but the form of the head and pronotum are those of Plagiognathus. In a measure they seem to connect these two genera. In the present species the upper surface is clothed with matted white hairs with some longer fuscous ones intermixed on the corium and cuneus.

Holotype (No. 436), female, allotype (No. 437), male, and paratypes in collection of the California Academy of Sciences.

37. **Europiella sparsa**, new species

A small thick-set pale greenish white insect, thickly clothed above with deciduous scale-like white hairs intermixed on the elytra with longer fuscous ones; femora and tibiæ dotted; length 3 mm.

Head broad and short, its width across the eyes three fourths that of the basal margin of the pronotum; nearly vertical, the face below somewhat inferior; its apex, viewed from the side, broad and square; produced below the eye for a distance almost equal to the length of the eye; clypeus flattish, poorly distinguished, its basal suture indistinct but obvious, on a line distinctly above the base of the antennæ; gula wanting. Rostrum attaining the hind coxæ; basal segment expanded reaching the base of the head. Antennæ short; basal segment about reaching apex of clypeus; second equal to the width of the head across the eyes; third about two thirds of second; fourth one half the third. Pronotum short and broad, feebly convex; sides but little oblique, feebly arcuated; hind margin straight: callosities indistinct. Basal field of scutellum covered. Elytra short and broad; costa distinctly arcuated. Hind femora broad and much flattened; third segment of hind tarsi scarcely longer than the second. Male genital characters obscure, the sinistral clasper small and transverse.

Color obscure testaceous-white, sometimes tinged with yellow or green, especially on the head and abdomen. Antennæ becoming infuscated on their apical half; Femora with a few large scattering brown dots toward their apex, more apparent on the hind pair and less conspicuous in the male, these dots tending to form a line near the lower margin. Tibiæ white, armed with large conspicuous black spines set in black dots. Eyes, apex of the tarsi and of the rostrum black. Oviduct of female more or less infuscated. Lower surface of male sometimes infuscated. Upper surface clothed with closely set silvery scale-like deciduous hairs, intermixed on the elytra with longer fuscous ones. Membrane immaculate.

Described from 10 male and 14 female examples taken on Atriplex at Coachella, Palm Springs and Soboba Springs, Calif., May 13, to June 2, 1917. Among our pale species *sparsa* may be distinguished by the stout black tibial spines and the sparse coarse dotting of the femora.

Holotype (No. 438), male, allotype (No. 439), female, and paratypes in collection of the California Academy of Sciences.

38. **Catonia helenæ**, new species

Form and size of *majusculus;* cinereous varied with fuscous and croceus; front with an interrupted black band at base and an indefinite area at apex; length 7-8 mm.

Vertex nearly square, a little wider posteriorly; carinæ prominent; anterior margin feebly rounded, passage to the front abrupt; basal margin scarcely angled. Front narrow, much wider at apex; sides straight; carinæ prominent; clypeus more convex with conspicuous carinæ. Elytra long and parallel; venation distinct; stigma about twice longer than wide and crossed at its basal third by an oblique suture, the margin beyond with three small areoles. Lateral plates of the female genital segment short, transverse, their hind edge feebly sinuated and their inner angle obtuse. Plates of the male lanceolate-triangular, acute at apex, their inner basal angles approaching, exteriorly fringed with short pale hairs; median valve produced in a long slender tooth which attains the middle of the plates.

Color soiled yellowish testaceous, tinged with fulvous on the front, mesonotum and elytral nervures. Foveæ of the vertex and pronotum in-

fuscated, those of the front black at base and infuscated at apex next the clypeus. Cheeks, pleural pieces and basal angles of the mesonotum marked with black; median compartments of the mesonotum clouded with black at base and again beyond the middle. Elytra cinereous becoming whitish at apex, with pale fulvous nervures, dotted and maculated with fuscous, the larger spots omitting the clavus and forming about three transverse vittæ on the corium; costal area with an elongated blackish spot near the base, a small one at apex and two well defined spots between; the apical two thirds of the stigma black; membranal portion mostly immaculate. Abdomen more or less clouded with fuscous on its disk; legs pale. Basal segment of the antennæ pale yellowish. Ocelli fulvous.

Described from 35 specimens, representing both sexes, taken on the dead reflexed leaves of the California fan palm, *Washingtonia filifera*, in Andreas' Canyon at Palm Springs, Calif., May 9, 1917. I have dedicated this interesting species to my wife, Helen Van Duzee, in recognition of her enthusiastic interest in entomological pursuits. This is our largest Catonia and quite distinct from any other known to me. It seems to be confined to this palm and to find its sustenance among the dead foliage only, as I was unable to obtain any from the living leaves.

Holotype (No. 440), male, allotype (No. 441), female, and paratypes in collection of the California Academy of Sciences.

39. **Catonia necopina**, new species

Allied to *nervata* and *albocostata;* dark fuscous-brown with the vertex and pronotum paler; costal and apical veins of the elytra whitish; length 5-5½ mm.

Vertex short, rounding over to the base of the front, the lateral carinæ forming a subacute angle before; base angularly emarginate. Front a little convex in both diameters, very slightly widened toward the clypeus with the sides feebly arcuated; sides acute but scarcely elevated; median carina obsolete; barely indicated at the clypeal suture; surface closely uniformly punctured as is also the clypeus, the latter with an indistinct median carina. Pronotum as in the allied forms. Mesonotum closely evenly punctured, the carinæ obtuse, nearly parallel. Elytra deep smoky subhyaline without reticulations or dots, the nervures distinct. Costal margin with but three areoles between the stigmatal and transverse veins. Lateral plates of the female genital segment transverse-quadrangular, their inner angles subacute; plates of the male about twice longer than wide, parallel, their apices obliquely cut off; median tooth half the length of the plates, rounded at apex.

Color deep smoky brown becoming a paler fulvous-brown on the head and pronotum; the patagiæ and costal margin whitish. Elytral nervures paler beyond the middle, more conspicuously whitish at apex. Front deep fuscous-brown shading to paler at base. Mesonotum tinged with cas-

taneous, the carinæ concolorous or slightly paler. Abdomen blackish fuscous, the segments edged with pale, the genital pieces mostly pale. Legs fuscous lined with pale, the tibiæ and tarsi mostly pale.

Described from one pair taken at Keen Camp, San Jacinto Mountains, June 9, 1917, on Mt. Tahquitz, at an elevation of about 7000 feet. The food plant is probably cypress. Among the allied species with uniformly fuscous elytra bordered and veined with pale this may be distinguished by the convex, ecarinate, punctured front.

Holotype (No. 442), male, and allotype (No. 443), female, in collection of the California Academy of Sciences.

PROCEEDINGS

OF THE

CALIFORNIA ACADEMY OF SCIENCES

FOURTH SERIES

VOL. VIII, Nos. 8 and 9, pp. 309–351 JUNE 16, 1919

VIII

REPORT OF THE PRESIDENT OF THE ACADEMY FOR THE YEAR 1918

BY

C. E. GRUNSKY
President of the Academy

Although no great event affecting the welfare and usefulness of the Academy can be announced as having occurred during the last calendar year, the Academy has nevertheless prospered and its membership may well be content with the fact that despite the adverse conditions which prevailed during the war, now happily ended, it has continued to function properly and its activities have not been seriously interrupted.

There has been but slight change in the number of members, as shown by the following summary:

The present membership in the Academy is 455, made up of:

Patrons	6
Honorary Members	32
Life Members	78
Fellows	14
Members	325

During the year 1918, 32 new members were admitted and the Academy lost by death 13, by resignation 18 and by being dropped for arrearages in dues 6.

Those who were called by death are as follows:

Mr. William Babcock	Member	January 23, 1918
Mr. Frederick H. Beaver	Member	July 23, 1918
Mr. George A. Clark	Member	April 27, 1918
Mrs. A. L. Coombs	Member	May 5, 1918
Hon. George W. Dickie	Member	August 17, 1918
Mrs. Sarah Vaslit Hackett	Life	November 3, 1917
Mr. William J. Hackmeier	Member	January 21, 1918
Judge Ralph C. Harrison	Life	July 18, 1918
Mr. Livingston Jenks	Member	November 11, 1918
Dr. Martin Krotoszyner	Member	April 20, 1918
Dr. Benjamin R. Swan	Life	January 27, 1918
Capt. Ignatius E. Thayer	Life	May 14, 1918
Mr. Joseph S. Tobin	Member	February 5, 1918
Mr. Clarence A. Waring	Member	November 4, 1918

The Academy carries on its list of patrons the following names:

Living

Mr. William B. Bourn
Mr. William H. Crocker
Mr. Peter F. Dunne
Mr. Herbert Fleishhacker
Mr. Joseph D. Grant
Mrs. Charlotte Hosmer
Mr. A. Kingsley Macomber
Mr. Alexander F. Morrison

Deceased

Mr. William Alvord
Mr. Charles Crocker
Mr. John W. Hendrie
Mr. James Lick
Mr. Ignatz Steinhart

The Treasurer's report for the year 1918 shows that the total receipts for the year were $67,885.96, of which $15,569.67 were paid out as interest. The receipts include $500.00 of the A. K. Macomber donation of $3500.00, which made the installation of the White Pelican group possible. Otherwise they are fairly representative of the annual gross income of the Academy. The floating debt of the Academy was reduced during the year by $14,000. The rest of the income has been consumed in maintaining the Academy's museum and in carrying on the activities of the Academy in its various departments. That these activities have been productive of good results is apparent in the increase of the Academy's scientific collections and in the publications of the Academy, and will be made clear, too, by the reports of the Director of the Museum and of the curators.

The Academy has published during 1918 the following papers in continuation of the Fourth Series of the Proceedings:

Vol. II, Part II, No. 12, pp. 1-187
A REVIEW OF THE ALBATROSSES, PETRELS AND DIVING PETRELS
by Leverett Mills Loomis.

Vol. VII, No. 12, pp. 319-330
REPORT OF THE PRESIDENT OF THE ACADEMY FOR THE YEAR 1917
by C. E. Grunsky.

Vol. VII, No. 13, pp. 331-364
REPORT OF THE DIRECTOR OF THE MUSEUM FOR THE YEAR 1917
by Barton Warren Evermann.

Vol. VIII, No. 1, pp. 1-25
IN MEMORIAM: THEODORE HENRY HITTELL.

Vol. VIII, No. 2, pp. 27-34
IN MEMORIAM: CARL FUCHS.

Vol. VIII, No. 3, pp. 35-112
SOME JAPANESE APHIDIDÆ
by E. O. Essig and S. I. Kuwana.

Vol. VIII, No. 4, pp. 113-156
GEOLOGY OF THE NORTHERN END OF THE TAMPICO EMBAYMENT AREA
by E. T. Dumble.

Vol. VIII, No. 5, pp. 157-179
THE KELP-FLIES OF NORTH AMERICA
by J. M. Aldrich

Vol. VIII, No. 6, pp. 181-270
THE GARTER-SNAKES OF WESTERN NORTH AMERICA
by John Van Denburgh and Joseph R. Slevin.

Vol. VIII, No. 7, pp. 271-308
NEW SPECIES OF HEMIPTERA CHIEFLY FROM CALIFORNIA
by Edward P. Van Duzee.

During the year 1918, 10 free lectures have been delivered at the stated meetings of the Academy, as follows:

JANUARY 16. The Sea Lions of the Pacific Coast of America.
Prof. E. C. Starks, Department of Zoology, Stanford University.

MARCH 20. Fishes of the Lake Bonneville Basin.
Prof. John O. Snyder, Department of Zoology, Stanford University.

APRIL 17. Sequoia National Park and its Extension.
Worth Ryder, Curator, Oakland Art Gallery.

MAY 15. Some Activities of the United States Department of Agriculture in California.
G. P. Rixford, Physiologist, Bureau of Plant Industry, U. S. Dept. of Agriculture.

JUNE 19. The Geography of Europe and the World War.
Prof. Earle G. Linsley, Department of Science. Mills College.

JULY 17. The Influence of the Weather on Human Activities.
Edward A. Beals, District Forecaster, United States Weather Bureau.

AUGUST 21. The Early Days of the Academy.
Charles B. Turrill.

SEPTEMBER 18. The Ways in which Insects are Modified or Adapted to their Environment and Mode of Life.
Dr. Edwin C. Van Dyke, Professor of Entomology, University of California.

OCTOBER 16. Some Philosophical Considerations of Mathematics.
Dr. Rufus L. Green, Professor of Mathematics, Stanford University.

DECEMBER 18. Birds of the High Sierras and their Environment.
Dr. William F. Badè, President, California Associated Societies for the Conservation of Wild Life.

The Sunday afternoon lectures delivered in the Museum building during the year 1918 included the following:

JANUARY 6. Midwinter Birds of Golden Gate Park.
Dr. Joseph Grinnell, Director of the Museum of Vertebrate Zoology, University of California.

JANUARY 13. Fish and Game in California.
Dr. H. C. Bryant, Expert, Fish and Game Commission.

JANUARY 20. Forest Insects.
Prof. R. W. Doane, Department of Entomology, Stanford University.

JANUARY 27. Experiences in a Georgia Swamp.
Prof. J. C. Bradley, Department of Entomology, Cornell University.

FEBRUARY 3. Bird Life as seen through the Camera,
Dr. J. Rollin Slonaker, Department of Physiology, Stanford University.

FEBRUARY 10. California Petroleum.
Dr. Roy E. Dickerson, Curator of Invertebrate Paleontology, California Academy of Sciences.

FEBRUARY 17. Our Nearest Neighbor, the Moon.
Prof. E. G. Linsley, Department of Geology and Astronomy, Mills College.

FEBRUARY 24. The Crab Fisheries of the Pacific Coast.
Dr. F. W. Weymouth, Department of Physiology, Stanford University.

MARCH 3. The Pacific Whale Fisheries.
Dr. Harold Heath, Professor of Zoology, Stanford University.

MARCH 17. Animal Experimentation and Medical Progress.
Dr. F. M. McFarland, Professor of Histology, Stanford University.

MARCH 24. Life on Other Worlds.
Dr. R. G. Aitken, Astronomer, Lick Observatory.

MARCH 31. Influence of California's Topography and Climate upon Man's Work.
Prof. R. S. Holway, Department of Geography, University of California.

APRIL 7. Circulation of the Blood.
Dr. A. A. D'Ancona, San Francisco Board of Education.

APRIL 14. Geology of California.
Dr. J. Perrin Smith, Professor of Paleontology, Stanford University.

APRIL 21. Development in Teaching Geography.
Dr. Marsden Manson.

APRIL 28. The Banking Problems of the War.
Professor M. S. Wildman, Department of Economics, Stanford University.

MAY 5. The Hetch-Hetchy Water Supply.
M. M. O'Shaughnessy, City Engineer.

MAY 12. Collecting Bird Groups with Gun and Camera.
Paul Fair, Department of Exhibits, California Academy of Sciences.

MAY 19. The Value to Mankind of Humanely Conducted Experiments, upon Living Animals.
Dr. F. B. Sumner, Biologist, Scripps Institution for Biological Research.

OCTOBER 6. The Changes in the Newtonian Law of Gravitation indicated by the latest researches on the Motions of the Planets and of the Moon.
Dr. T. J. J. See, Professor of Mathematics, United States Navy.

OCTOBER 13. The coming Commonwealth of Man.
Edward Berwick, Member of the Institute of International Law.

NOVEMBER 24. Animal Life of the Apache Trail, Arizona.
Harry S. Swarth, Curator of Birds, Museum of Vertebrate Zoology, University of California.

DECEMBER 1. Some Activities of the United States Department of Agriculture in California.
G. P. Rixford, Physiologist, Bureau of Plant Industry, United States Department of Agriculture.

DECEMBER 15. Building of the first Transcontinental Railroad.
Charles B. Turrill.

DECEMBER 22. The Application of the Science of Geology in Exploration for Oil.
Dr. Bruce L. Clark, Department of Paleontology, *University of California.*

DECEMBER 29. The Lessons of the Southeast Wind.
Dr. Marsden Manson.

In the matter of the Ignatz Steinhart bequest of $250,000 to the Academy for the erection and equipment of an aquarium in Golden Gate Park, it can now be reported that the city through a charter amendment, adopted at the election last November, has been definitely committed to an acceptance of the conditions named in the bequest. Your Board of Trustees, too, has signified to the Executors of the Estate their acceptance of the trust imposed by the Steinhart will. There are, therefore, no obstacles in the way of proceeding with the making of plans and the erection of the building except only those incident to settling up an estate which consists in large part of real estate for which there is no immediate demand.

Since the close of the year of which this report is a brief record, the Council of the Academy has been advised by Mr. John W. Mailliard and Mr. Joseph Mailliard that their large and valuable collection of eggs and bird skins is to be donated to the Academy. The plan of transfer, tentatively suggested and which will within a few days be put into effect, will obligate the Academy to immediately furnish space for a part of the collection, which the Mailliard brothers desire to have adequately housed in the Museum building. The rest of the collection will follow from time to time at their pleasure; but the question of ultimate ownership will be at once definitely settled.

The Academy is fortunate indeed to thus acquire the results of the lifetime work of two enthusiastic students of birds, who have both long been active members of the Academy; and I take this occasion to express the Academy's deepest gratitude to the donors. May they continue to take the same satisfaction and pleasure in the collection in a new home as they have heretofore.

Preliminary announcement should be made, too, of the fact that under the terms of the will of the late S. Field Thorn, long a resident of San Francisco, the Academy is to receive a tract of land near Santa Cruz, containing about 240

acres. Apart from the advantage that would come to the Academy by being thus placed in possession of more property, if the desire of the testator be not frustrated, with corresponding increase of opportunity to be of service in the advancement of science, such bequests show that the Academy's work and its efforts to be of service in the community are being appreciated in ever widening circles.

The accessions to the Museum and Library for the year 1918 may be summarized as follows:

Department of Botany		
By Exploration	1216	specimens
By Gift	805	
By Exchange	1005	
By Purchase	1230	
	4256	
Department of Entomology		
By Exploration	10,019	specimens
By Gift	5,116	
By Exchange	43	
	15,178	
Department of Herpetology		
By Exploration	1119	specimens
By Gift	605	
	1724	
Library		
Books, pamphlets and excerpts		
By Gift	1077	
Department of Paleontology		
By Exploration	447	specimens
By Gift	339	
	786	
Numerous boxes of fossils, shells and minerals.		
Department of Ornithology		
Important accessions of skins, nests and eggs of birds.		
Department of Mammalogy		
By Gift	139	specimens

In the Mammal Hall of the Museum the fur-seal group is under preparation. In the Bird Hall the generosity of Mr. Herbert Fleishhacker and of Mr. A. K. Macomber has made possible the installation of two more attractive large-size habitat groups, that of the Water-Fowl group of San Joaquin Valley and the White Pelican group respectively. These were

both opened to the public during the year and it may be noted that the artistic finish of the background paintings by Capt. Chas. B. Hudson, has received much favorable comment and so, too, the general arrangement and the grouping of the birds by Mr. Paul Fair. A number of the smaller groups, too, have been added in this hall.

For large exhibits the space in the Bird Hall is now exhausted, and there are but two alcoves not yet in use in the Mammal Hall. The space which the new building provided a few years ago, is already practically in full use. The Academy needs an auditorium. This is evidenced by the large attendance at the popular Sunday afternoon lectures, for which the space temporarily provided is not well suited. This space should be added to the Bird Hall. The need is pressing, in other words, for another section of the Museum building. May we not hope that, recognizing this need and the earnest endeavor of the Academy to be of public service, that some one or more of those of this community who have the means to do so will come to the Academy's aid in this matter and provide the funds which would enable an expansion of its museum and of its general activities.

The activities in the several departments are fully set forth in the reports of the Director of the Museum and of the Curators. I need only say that the work that is being done is creditable to the Academy and that there is no lack of interest and endeavor to meet the task which the Academy has made its own.

The time has now come for making some effort to increase the membership of the Academy. Our dues are nominal, only $5.00 per annum, and there is no admission fee. Any one interested in science or desiring to aid in the advancement of science is eligible to membership. The Council plans to name and maintain a membership committee and requests that notice be sent of any person desiring to become a member.

On behalf of the Officers of the Academy, I desire to again express their appreciation of the support which they have received from the membership in their efforts to make the Academy useful and of service to the public. I take pleasure, too, in acknowledging the faithful service which has been rendered by its staff of employees.

IX

REPORT OF THE DIRECTOR OF THE MUSEUM FOR THE YEAR 1918

BY

BARTON WARREN EVERMANN
Director of the Museum

The annual report of the Director for the year 1917 was presented to the Academy at the annual meeting of February 20, 1918. At that time the following habitat groups had been completed:

Large groups: San Joaquin Valley Elk, Columbian Black-tailed Deer, Rocky Mountain Mule Deer, Antelope, Desert Mountain Sheep, Stellar's Sea Lion, California Sea Lion, Leopard Seal, Farallon Islands Bird Rookery, San Joaquin Valley Bird Group, Desert Bird Group, San Joaquin Valley Water-Fowl Group, and California Condor.

Intermediate groups: Mountain Lion, Northwestern Black Bear, Raccoon and Striped Skunk, and Coyote.

Small groups: California Ground Squirrel, Santa Cruz Chipmunk, California Valley Quail, California Clapper Rail, California House Finch, and Coast Bush-Tit. The installation of the Sulphur-bottom Whale skeleton had also been completed. During the past year the following habitat groups have been completed:

White Pelican.—This is one of the most interesting and instructive, as well as beautiful, groups that have been installed. It represents a portion of the breeding ground of the White Pelican on Anaho Island in Pyramid Lake, Nevada.

This rookery was selected in preference to any of those in California (Buena Vista Lake, Eagle Lake, and Klamath Lakes) because the topography presented an exceptionally fine setting for the group. More than 10,000 birds nest on this small island. The group was prepared by Mr. Paul J. Fair, assisted by Mr. Arthur L. Reed and Miss Olive E. Cutter. The background was painted by Charles Bradford Hudson.

The Academy has been able to install this very beautiful exhibit through the liberality of Mr. A. K. Macomber of Paicines and Burlingame, who very generously met the expense connected with its preparation.

Nuttall Sparrow.—This is one of the small panel groups. It shows a pair of this subspecies of the White-crowned Sparrow and their nest placed in a Yellow Lupine *(Lupinus arboreus)* as found in the sand dune region in the western part of Golden Gate Park.

As the Nuttall Sparrow is the most abundant and most familiar permanent resident of all the birds of the Park, this group is of unusual interest to the school children who visit the Museum.

This group was prepared by Mr. Fair, assisted by Mr. Reed and Miss Cutter. The background was painted by Miss Cutter.

Sharp-Shinned Hawk.—This is another of the small panel groups. The Sharp-shinned Hawk is of occasional occurrence in Golden Gate Park where it is destructive to the smaller birds. In the group a hawk of this species is shown with a Western Bluebird in its talons. The brightly colored foliage is that of the Poison Oak.

We therefore have completed at this date 14 large, 25-foot groups (eight mammal and six bird), four intermediate, 10-foot groups (all mammals), and eight small panel groups (two mammal and six bird).

Other groups now in preparation are the Fur-Seal (nearly completed), the Roosevelt Elk, the Water Ouzel (nearly completed), and the Audubon Cottontail *(Sylvilagus auduboni)*.

PERSONNEL

Only one or two slight changes in the personnel of the Museum have occurred within the year. Mr. James H. Chastain, janitor, resigned March 31 to engage in mining operations, and assistant janitor Wm. C. Lewis was promoted to janitor. On the same date Mr. Fred Maag was appointed assistant janitor and carpenter. On April 1, Mr. Geo. W. Edwards was appointed assistant janitor. Mr. Joseph R. Slevin, assistant curator of Herpetology, having been com-

missioned an ensign in the United States Navy, was granted indefinite leave of absence without pay July 31. He returned to duty February 1, 1919. Miss Mary E. McLellan was appointed check-room attendant March 16, 1918, and on August 1, promoted to the position of library assistant.

The employees of the Academy at this date are the following:

Dr. Barton Warren Evermann, Director and Executive Curator of the Museum, and Editor; W. W. Sargeant, Secretary to the Board of Trustees; Miss Susie Peers, Stenographer and Typewriter; Joseph W. Hobson, Recording Secretary; Miss Alice Eastwood, curator, Department of Botany; Edward P. Van Duzee, curator, Department of Entomology and assistant librarian; Dr. John Van Denburgh, curator, Department of Herpetology; Dr. Roy E. Dickerson[1], curator, Department of Invertebrate Paleontology; Dr. Walter K. Fisher, curator, Department of Invertebrate Zoology; Paul J. Fair, chief taxidermist; Charles Bradford Hudson, artist; Joseph R. Slevin[2], assistant curator of Herpetology; John I. Carlson[3], general Museum assistant; Arthur L. Reed, assistant, Department of Exhibits; Miss Olive E. Cutter, assistant, Department of Exhibits; Mrs. Marian L. Campbell, assistant, Department of Botany; Mrs. Helen Van Duzee, assistant, Department of Entomology and in the Library; Miss Mary E. McLellan, library assistant; Georges Vorbe, assistant, Department of Paleontology; Merle Israelsky, assistant, Department of Paleontology; Raymond Smith, general assistant; Wm. C. Lewis, janitor; Fred Maag, assistant janitor and carpenter; Geo. W. Edwards, assistant janitor; Frank W. Yale, night watchman; Mrs. Johanna E. Wilkens, janitress; Patrick J. O'Brien, day watch.

ACCESSIONS TO THE MUSEUM

As in previous years, the accessions to the Museum have been numerous as shown by the detailed list in the appendix to this report. A few of the more notable ones are referred to in the President's report (pp. 314-315).

[1] On leave with the Standard Oil Company since June 30.
[2] On leave in the U. S. Navy since July 31.
[3] On leave since March 15.

VISITORS TO THE MUSEUM

On account of the prevalence of Influenza in San Francisco the Museum was closed to the public from Saturday, October 19, to Saturday, November 16, both inclusive. With the exception of this period of 29 days, the Museum has been open to visitors every day.

Although the attendance has been large it has, of course, suffered somewhat on account of war conditions and especially the Influenza. The daily visitors have varied from a few hundred on stormy days to more than 9000 on favorable days.

The public and private schools not only of San Francisco but of the transbay cities continue to visit the Museum, the teachers bringing the entire school to study the habitat groups and other educational exhibits. The Director endeavors, whenever possible, to conduct the classes about the Museum and explain the various exhibits. When time permits the schools are taken into the lecture hall where a special lesson is given with stereopticon slides and moving pictures on some one of the groups. The children thus leave the Museum with at least one lesson clearly impressed on their minds.

The attendance by month during the year 1918, was as follows:

January	25.260
February	23,698
March	26,810
April	23,274
May	26,391
June	29.843
July	31,420
August	31,137
September	29,847
October	14,743
November	8,531
December	19,588
Total	290,542

LECTURES

A course of free popular lectures on scientific subjects has been maintained throughout the year, on the third Wednes-

day evening of each month. These have been given at the regular monthly meetings which, through the courtesy of the Engineers' Club of San Francisco, have been held in the hall of that society on the ninth floor of the Mechanics' Institute building. The list of lectures and their subjects will be found in the President's report (pp. 311-312).

The Academy has continued the Sunday afternoon course of popular lectures which were begun October 22, 1916, soon after the Museum was formally opened to the public. These lectures are given in the auditorium of the Museum at 3 o'clock each Sunday afternoon. The popularity of the course remains undiminished; the size of the audiences has been limited only by the size of the auditorium. The lecture committee for the year, Mr. W. W. Sargeant, Miss Alice Eastwood and Mr. Paul J. Fair, has been energetic and resourceful in securing lecturers and arranging the details for these lectures. A list of the lectures given in 1918 will be found on pages 312-314 of the President's report.

Attention is again called to the fact that the Academy has no funds from which to meet even the slight expense connected with these lectures. It is hoped that some friend of the Academy who feels an interest in the educational work it is doing may provide a small endowment the income from which can be applied to the expenses of public lectures.

FIELD WORK OF THE MUSEUM STAFF

Within the year the Museum conducted a number of important field investigations, as follows:

Channel Islands.—During the latter part of March (March 22-31) the Museum sent an expedition to the Channel Islands off the coast of southern California. The party consisted of the Director of the Museum, the Curator and Assistant Curator of the Department of Herpetology, Mr. Joseph Mailliard of San Francisco, and Mr. J. Eugene Law of Los Angeles. Through the courtesy of the California Fish and Game Commission the party was able to visit San Clemente, San Nicolas, Santa Barbara, and Santa Catalina islands. This opportunity is taken to express to the officials of the Fish and Game Commission, especially Mr. Carl Westerfeld, Executive

Secretary; Mr. N. B. Scofield, assistant in charge of commercial fisheries; and Captain H. B. Nidiver of the Commission's patrol boat Albacore, the appreciation of the members of the party of the courtesies extended. Captain Nidiver did everything possible to enable the party to work effectively during the entire period of the trip. Equal appreciation must be expressed also to Mr. E. G. Blair, President of the San Clemente Sheep Company, for permission to land on San Clemente Island and for making our stay on that island very pleasant. We are also indebted to Captain H. W. Rhodes, Inspector 18th Lighthouse District, for permission to land on several lighthouse reservations.

The trip to the islands proved quite successful. A large collection of lizards was obtained on San Clemente, and considerable collections of birds, nests and eggs, insects, shells, and plants were obtained from the various islands. One interesting result of the expedition was the addition of several birds to the known fauna of the islands, including the Pied-billed Grebe and Arkansas Kingbird on Santa Catalina; a species of Junco (probably Thurber's), Western Chipping Sparrow, Lincoln Sparrow, Dusky Warbler, and Audubon Warbler on Santa Barbara, and what was believed to be the Cactus Wren on San Clemente[4].

Northern California and Southern Oregon.—From May 29 to July 7, a party consisting of the Director of the Museum and the Curator and Assistant Curator of Herpetology made a collecting trip through northern California and southern Oregon chiefly in the interests of the departments of Herpetology and Ornithology. The expedition was a camping trip and large and valuable collections of reptiles and birds' nests and eggs were obtained.

USE OF THE ACADEMY'S COLLECTIONS AND LIBRARY BY INVESTIGATORS AND STUDENTS

Students and investigators in the various departments have continued to avail themselves of the facilities for study and research which the Academy is always glad to supply. Space will permit the mention of only a few of the specialists who have made use of our collections. Dr. Joseph Grinnell has

[4] See Joseph Mailliard in the Condor, XX, No. 5, September-October, 1918, p. 189.

consulted the collections of wood rats and elk. The ornithological and oological collections have been consulted by a large number of students of birds, including L. M. Loomis, Joseph Mailliard, Harry S. Swarth, Joseph Grinnell, John Van Denburgh, O. P. Silliman, Roswell Wheeler, Donald G. Cohen, Harold C. Hansen, Chase Littlejohn, and others.

In Entomology, practically all the entomologists of California have made frequent use of the collections. Among those who should be especially mentioned are Dr. Frank E. Blaisdell, Dr. E. C. Van Dyke, Mr. Lawrence R. Reynolds, Mr. Ralph Hopping, Prof. F. C. Fall, Prof. J. M. Aldrich, Mr. Walter M. Giffard, Mr. Wm. F. Breeze, Mr. Chas. L. Fox, and many others. The curator of this department has been particularly active and successful in securing the cooperation of specialists to identify our collections in the various groups, as set forth fully in the curator's report. Dr. Blaisdell particularly has rendered very valuable service in identifying the Coleoptera.

The collections and publications in the department of Paleontology have been consulted by many of the paleontologists, malacologists, and geologists of the Pacific Coast, among whom should be mentioned Professor Charles W. Weaver, and Miss Katheryn Van Winkle of the University of Washington; Dr. Earl L. Packard of the University of Oregon; Dr. Bruce L. Clark of the University of California; Dr. W. S. W. Kew, associate geologist, U. S. Geological Survey; Mr. Clark Gester, geologist, Southern Pacific Company; Mr. Parker Trask, Mr. Anthony Folger and Miss Esther Richards, graduate students, University of California; Professor Woodruff, Pomona College; Mrs. Ida S. Oldroyd, Stanford University; Mr. F. M. Anderson, consulting geologist; Dr. J. O. Nomland, geologist, Standard Oil Co., and several others.

In the department of Botany practically all the botanists of California have made use of the herbarium in verifying their identifications of specimens or in other ways.

In addition to this, much of the time of the Director and Curators has been employed in answering questions or supplying information requested by correspondents or visitors. As the Museum becomes better known and specialists and students

come to understand that we are always ready to be of service, the requests for information increase in number. While this takes much time of the Director and Curators, it is proper educational work and real service which the Museum is always glad to render.

RESEARCH WORK

The members of the Museum staff have been active in research and scientific investigation. They have contributed a number of papers to scientific literature, among which the following may be mentioned:

Van Denburgh, John and Slevin, Joseph R.

1. The Garter-Snakes of Western North America. <Proc. Calif. Acad. Sci., Fourth Ser., Vol. VIII, No. 6, pp. 181-270, pls. 7-17, October 18, 1918.

Van Duzee, Edward P.

1. New Species of Hemiptera chiefly from California. <Proc. Calif. Acad. Sci., Fourth Ser., Vol. VIII, No. 7, pp. 271-308, October 18, 1918.

Evermann, Barton Warren

1. Notes on some Adirondack Reptiles and Amphibians. <Copeia, No. 56, April 15, 1918, pp. 48-51.
2. Notes on some Reptiles and Amphibians of Pike County, Pa. <Copeia, No. 58, June 18, 1918, pp. 66-67.
3. George Archibald Clark. <Science, n. s. XLVIII, No. 1235, August 30, 1918, pp. 213-215.
4. Notes on some Reptiles and Amphibians of Waterville, New Hampshire. <Copeia, No. 61, September 15, 1918, pp. 81-83.
5. Note on Flyingfishes. <The Catalina Islander, Vol. V, No. 42, November 5, 1918, p. 4.
6. The Unionidæ of Lake Maxinkuckee. <Proc. Ind. Acad. Sci, 1917, pp. 251-285. (Senior author with Howard Walton Clark.)
7. Fisheries Experiment Stations. <Pacific Fisherman, Vol. XVI, No. 12, December, 1918, p. 11.

DEPARTMENT ACTIVITIES

Although war conditions disorganized the work of the Museum to some extent the curators and their assistants have, as always, been active and efficient in increasing and caring for the collections in different departments, and in research work based upon the collections of the Museum. The condition and activities of the different departments are fully set

forth in the reports of the respective curators and need be referred to here only briefly.

The Department of Entomology did considerable field work. The curator, Mr. E. P. Van Duzee, spent four weeks in Shasta and Siskiyou counties, California, and Jackson County, Oregon, during which important collections were obtained. He also made numerous shorter collecting trips to the vicinity of Los Baños, Sacramento, Mt. St. Helena, Cazadero, and elsewhere.

The Department of Paleontology.—Although Dr. Dickerson, the curator of this department, has been on leave most of the year, he nevertheless did some work on the Petaluma, Sonoma and Tomales quadrangles which added materially to our knowledge of those regions and to the Academy's collections of fossils. During the time the curator has been on leave he has had opportunity to do some collecting for the Academy.

Department of Botany.—Miss Eastwood, the curator of this department, has continued with her characteristic energy and industry to build up and care for the Herbarium which now contains more than 50,000 specimens all properly identified and authenticated, besides many specimens of fungi not yet fully determined. Many important additions to the Herbarium have been made during the year as set forth in detail in the curator's report.

Department of Herpetology.—The curator and assistant curator have been active in enlarging, caring for, and studying the collections of this department. Two important collecting trips were made, one in March to the Channel Islands, the other in June and July through northern California and southern Oregon, which added more than 1000 specimens to the collections. The total accessions in the year number 1724, and the total number in the department now exceeds 37,000.

Department of Ornithology.—Such field work as was done in the interest of this department was chiefly in the section of oology, to which very little attention has hitherto been given. The total number of specimens added to the Academy's collection of nests and eggs during the year exceeds 1600, some of them rare and of unusual interest. During the nest-

ing season the Director made numerous short week-end collecting trips to Los Baños and other nearby fields. One longer trip was made to the Channel Islands in March, and another in June and July through northern California and southern Oregon, which added greatly to the Academy's oological collections. Suitable cases have been provided in which these collections are now being arranged.

Department of Mammalogy.—No effort has been made to enlarge the collections in this department. A few miscellaneous specimens were, however, received, including specimens chiefly from Marin County donated by Mr. Charles A. Allen, the veteran naturalist and collector of San Geronimo, and 87 specimens chiefly from California, donated by the well-known collector, Mr. J. August Kusche.

A considerable number of mammal skulls having accumulated, Miss Lula M. Burt, an expert preparator, has been employed for some weeks in cleaning skulls and skeletons. More than 1200 skulls have already been cleaned by Miss Burt.

Department of Invertebrate Zoology.—The curator of this department, Dr. W. K. Fisher, was invited by Dr. C. C. Nutting of the University of Iowa to accompany an expedition organized by that institution for study of the marine fauna of the Lesser Antilles. Through an arrangement with Stanford University, Dr. Fisher was permitted to represent the Academy and that institution. He sailed from New York for the Antilles April 19th and returned August 1st. Collecting was done about Antigua and the Barbados and considerable collections of marine invertebrates were obtained.

Some work was done by the department at the San Juan Islands, Puget Sound, where important collections were obtained for the Academy by Mrs. Ida S. Oldroyd.

Library.—Very gratifying progress has been made in putting the library in proper shape, especially in accessioning the volumes. More than 8000 volumes have been accessioned. These include all the volumes on the second floor and all those in the departments of Ornithology, Herpetology, Botany and Paleontology. Valuable assistance has been rendered the librarian by Miss Mary E. McLellan and Mrs. Helen Van Duzee.

The Academy has not had available the funds really necessary for the proper growth of the library, nevertheless the accessions have numbered about 400 complete volumes and several hundred pamphlets.

THE ACADEMY AND THE WAR

Many members of the Academy, including several of the Museum staff were active in war work of one kind or another. The Academy's service flag contains 17 stars. Mention should first be made of those who were in actual war service. The list includes the following:

ALBERT L. BARROWS. Entered Officers Training Camp May, 1917; commissioned in August First Lieutenant, Cavalry; at Camp Lewis in August given commission First Lieutenant, Infantry; was made Adjutant of the 347th Machine Gun Brigade; embarked for France July, 1918; still in France.

CHARLES L. CAMP, First Lieutenant, Field Artillery, American Expeditionary Forces, France.

CHARLES T. CROCKER, Chief Petty Officers January 5, 1918. Commissioned as Ensign, January 13, 1919. Detailed to the Naval Communication Service in Third Naval District, in Office of Cable Censorship. Still in active Service.

WILLIAM WELLER CURTNER. Entered the service October 14, 1918; sent to Vancouver Barracks, Washington; placed in the 15th Casual Detention Company of the Spruce Production Division. Honorably Discharged December 13, 1918.

MERLE ISRAELSKY, Aid Department of Paleontology, California Naval Unit, October 11 to December 21, 1918.

CHARLES A. KOFOID, Major, Sanitary Corps, National Army, January, 1918. Still in service.

NORMAN B. LIVERMORE. Entered U. S. Army Service September 2, 1917. In October, 1917, commissioned as Captain of Engineers and sent to France. In France during the close of 1917 and entire year of 1918. Promoted to Major in the fall of 1918. Discharged about the middle of January, 1919, in the United States.

WAYNE F. LOEL. Enlisted June 29, 1918, and assigned to 115th Engineers at Camp Kearny; entered Engineers Officers Training School at Camp A. A. Humphreys September 19, 1918; discharged at Camp Humphreys November 27, 1918.

ATHOLL MCBEAN, Director of the Bureau of Personnel, Pacific Division, the American Red Cross, February 1 to April 24, 1918. Deputy Commissioner of the Switzerland Commission of the American Red Cross, and Director of American Prisoner Relief, April 24 to October 31, 1918.

WILLIAM W. PRICE, Captain, American Red Cross, Director of Red Cross Base Hospital, Camp Fremont, January 20, 1918, to October 12, 1918.

WILLIAM G. REED, Captain, Signal Corps, Aviation Section, American Expeditionary Forces, France.

LAURENCE R. REYNOLDS, General Staff of the War Department, October 17, 1918, to November 1, 1918.

THOMAS J. J. SEE, Captain U. S. Navy, Mare Island, California.

JOSEPH R. SLEVIN, Assistant Curator, Department of Herpetology. Ensign U. S. Naval Reserve, July 22, 1918. Promoted to Lieutenant January 24, 1919; released from active duty January 25, 1919. Service on the U. S. S. Beaver.

STANLEY STILLMAN, Lieutenant Commander, U. S. Navy. Commander U. S. Navy Base Hospital No. 2, Scotland, December, 1917, to January, 1919.

TRACY I. STORER, First Lieutenant, Sanitary Corps, Laboratory Car "Metchnikoff", Fort Sam Houston, Texas.

LANSING K. TEVIS, First Lieutenant, Aviation Service.

JOSEPH C. THOMPSON, Medical Director, U. S. Navy.

F. VICKERY, Lieutenant, U. S. Army.

CHARLES E. VON GELDERN, First Lieutenant, U. S. Medical Corps, Camp Fremont, California.

In addition to those engaged in actual war service a great many members of the Academy rendered important service to their country; indeed, it can be truthfully said that practically the entire membership of the Academy rendered valuable service in one way or another. Some were engaged in Red Cross, Y. M. C. A., or Liberty Loan work, while others served on important scientific and other committees working in connection with the National and State Councils of Defense, the Federal Food Administration, and other Federal or State agencies. One of these was the Committee on Scientific Research of the State Council of Defense for California, practically the entire membership of which was made up of members of the Academy, as was also that of each of the several special committees (Geology, Oil, Zoological Investigations, etc.) working under the general authority of the State Council of Defense and directly under the Committee on Scientific Research.

Some of the more important committees may be given here. The members of the Academy are indicated by the star.

Pacific Coast Research Committee of the Pacific Division of the American Association for the Advancement of Science: John C. Merriam, Chairman; *Douglas H. Campbell; *W. W. Campbell; *Barton W. Evermann; *E. C. Franklin; A. O. Leuschner; D. T. MacDougal; Geo. H. Whipple.

Committee on Botanical Investigations: *Harvey M. Hall, Chairman; *Douglas H. Campbell; *Wm. A. Setchell.

Committee on Entomological Investigations: *W. B. Herms, Chairman; *R. W. Doane; *E. O. Essig; G. P. Weldon.

Committee on Zoological Investigations: *Barton Warren Evermann, Chairman; *Harold C. Bryant; W. C. Crandall; *S. J. Holmes; *Charles A. Kofoid; *Frank M. MacFarland; *Wm. E. Ritter; *Norman B. Scofield; *J. Rollin Slonaker; *John O. Snyder; *E. C. Starks.

*Doane, R. W., Chairman, Committee on Entomological Investigations of the Pacific Coast Research Conference. Since December, 1917, Consulting Entomologist of the Federal Food Commission for California.

*Hall, Harvey M., Member of the Committee on Botanical Raw Products of the National Research Council. Vice-Chairman of the Sub-committee on Botany of the Pacific Coast Research Conference.

*Lilienthal, Jesse W., Chairman of the War Camp Community Service, Vice-Chairman of the San Francisco Chapter of the American Red Cross, and President of the Boy Scouts of San Francisco. Division Commander in both of the Red Cross drives, and State Chairman of the United War Work Campaign.

*Mailliard, Joseph, Operative and assistant chief of San Francisco Branch, American League, Auxiliary to U. S. Department of Justice, August 15, 1918, to February 1, 1919.

DEPARTMENTAL REPORTS

Department of Botany

By Alice Eastwood, *Curator*

The herbarium of the California Academy of Sciences now numbers 50,559 specimens all mounted and classified according to the latest system. It includes both Phanerogams and Cryptogams. Altogether there are 3116 genera and 17,112 species.

The Cryptogams are not so well represented as the Phanerogams, but there are some notable collections. Among the Lichens is the Hasse collection which has been purchased by the Academy. It furnished the material for "Contributions from the U. S. National Herbarium, Vol. 17, part 1, The Lichen Flora of Southern California by Hermann Edward Hasse". The total collection of lichens contains 89 genera, 320 species, and 394 specimens. The collection of mosses contains 140 genera, 298 species, and 674 specimens most of which were donated by Dr. C. Hart Merriam. The collection of hepatics contains 13 genera, 21 species, and 40 specimens.

The collection of fungi is the most valuable of the Cryptogams since it consists of the 474 types from the Harkness collection which were saved from the great fire. A few have been added from time to time by the curator, but are at present unlisted as the determinations are uncertain.

Besides these types of California fungi, there are 1855 Phanerogams, most of which were also saved from the fire, and eleven Galapagos types and cotypes of Allocarya recently determined by C. V. Piper. This material was loaned to the National Herbarium and the results of Mr. Piper's studies will soon appear in one of the contributions from the National Herbarium. The Academy's herbarium contains also a number of new species to be described soon, which will add to the accumulation of types.

The additions to the herbarium have come in various ways; 1005 specimens were received in exchange, 807 came as gifts from 24 different donors, most of them being specimens for identification. The curator added 1300 specimens and many duplicates. Besides the Hasse collection of lichens the Academy purchased the valuable mounted collection of Idaho specimens which formed the herbarium of John M. Holzinger. These plants were collected in the region traversed by the Lewis & Clark Expedition and the report on them was published by Professor Holzinger in Contributions from the U. S. National Herbarium, Vol. III, No. 4.

The southern California branch of the U. S. Forest Service presented the Academy with its herbarium. This consisted of 149 mounted sheets, chiefly specimens of Eucalyptus, representing almost as many species as specimens; also 93 bottles containing seeds of 86 species of Eucalyptus. This is a valuable addition to our herbarium and will be of great assistance in identifying the numerous species of this difficult genus so widely cultivated in California.

The Botanical Club numbers sixty-five members and holds weekly meetings. These are chiefly field trips, some in Golden Gate Park to study the exotics and others in the San Francisco Bay region, where cultivation

has not destroyed the native flora. These out-of-doors excursions can be held all winter and are not only more instructive than lectures or books, but more enjoyable. A weekly class of the gardeners of Golden Gate Park is also conducted in the evening at the herbarium so as to enable these men to have correct knowledge of the plants under their care. They bring in specimens which are useful in the Museum flower show. This exhibition of the native and exotic plants blooming throughout the year out-of-doors in San Francisco and around the Bay has been one of the most popular of the educational influences of the Academy and is greatly appreciated by the flower-loving public. Without the faithful care of Mrs. Johanna Wilkens, who has kept the water replenished, the shelves clean and the dead flowers removed, it would be impossible to keep up this exhibition in a satisfactory manner. Each species is labelled with scientific and common name and native country.

The framed pictures of edible and poisonous mushrooms in the little room off the vestibule have lured the lovers of mushrooms to the herbarium to discover the good or bad qualities of many that are common chiefly in the Park. On account of the lack of literature it has not been possible to answer all these inquiries. A collection of wax models, correctly colored and named would be a valuable addition to the Museum and I would like to suggest that a beginning be made during the ensuing year. A complete collection would have to be the work of many years and it would be necessary to send those that are unknown to authorities for correct naming.

At last, Mr. McLaren, the superintendent of the Park, has begun the planting of the court back of the Museum with trees and shrubs common in the Park but arranged, when possible, in the scientific sequence of families, so that it will be a botanical garden of a new kind and instructive as showing the evolution from the lower to the higher orders.

The plot of ground which faces the court is soon to be planted with trees and shrubs of the Bible and a small plot of ground has been reserved for the plants mentioned in Shakespeare's plays. These groups of plants will be of great interest to many people. However, without labels they will have no educational value and I would like to suggest that the Academy purchase a labelling machine so as to permanently label these plants as well as making a beginning towards labelling the trees and shrubs throughout the Park.

The curator had a leave of absence in May and June and was away six weeks. Part of the time was spent in collecting and collections were made at Portola and Loyalton in California, and in Buena Vista, Leadville, Glenwood Springs, Grand Junction in Colorado, at Thompsons Springs, Soldiers Summit, Thistle and Salt Lake in Utah. Earlier in the year a trip was made to Downieville, also to Tres Pinos and San Benito, to study the willows. Professor C. S. Sargent paid the railroad fare on these short trips. The expenses of the trip to Colorado were paid by the curator.

As new specimens have come in, they have been mounted, and much back work that had to be left undone has been completed, so that we are now about caught up and shall begin the new year of the Academy with the collections that have come in recently but are not yet incorporated into the herbarium.

These collections include an herbarium of 1464 specimens collected by the late Dr. E. K. Abbott of Salinas and Monterey, and presented to the Academy by his widow; 48 specimens from Afognak, Alaska, collected and donated by Russel Noyes; 26 unnamed specimens from Canton, China, collected and donated by Caroline Rixford Byrd; also at Mrs. Byrd's suggestion, 199 specimens from southern China donated by the Christian College, Canton, China. A collection of 200 desert plants collected by Roxana S. Ferris in southern California and Arizona has been purchased by the Academy.

A great many duplicates have been distributed to various botanical centers with which the Academy exchanges. Some of these were in return for what had already been received, while others have been sent in expectation of returns to be later received.

The Arnold Arboretum	305
U. S. National Museum	1631
Gray Herbarium, Cambridge, Mass.	933
New York Botanical Garden	713
Missouri Botanical Garden	253
Ira W. Clokey, Denver, Colo.	864

Besides these there have been distributed through the Arnold Arboretum duplicates of Yukon trees and shrubs collected in 1914 to the following:

Geological & Natural History Survey of Canada	318
U. S. National Museum	397
Royal Herbarium, Kew, England	256
Missouri Botanical Garden	216

Through the valuable help of my assistant, Mrs. Marian L. Campbell, we have at last caught up with the accumulated piles of unmounted specimens and the new year will see the mounting of the accessions as they come in. Mrs. Campbell has mounted 6039 specimens and Mrs. E. C. Sutliffe has mounted the collection she made in Sierra and Plumas counties in the summer of 1918, consisting of 138 specimens which she has donated to the herbarium.

The list of accessions will be given in the general report of accessions.

Besides the popular Sunday lectures which the curator has given at the Academy, many informal talks on trees and flowers have been given to various clubs and to flower shows. These help to extend the influence of the Academy in popularizing science.

Department of Entomology

E. P. Van Duzee, *Curator*

The significant work in the department of entomology during the past year was the development of the collection of North American insects, the important nucleus about which must be elaborated all future activities of

this department. Until we know our home insects we can be of little service to enquiring beginners in entomology; nor can we make our work interesting to the general public or properly carry on the investigations of a more technical nature which devolve upon this department of the Academy.

Additions to the department of entomology during the past year number 17,152 specimens of which 7,477 were received as gifts from friends of the Academy and 9,675 were added by the labors of the curator. The principal gifts of the year were: from Dr. F. E. Blaisdell, 1888 specimens of beetles which added 879 species to the Academy collections; from Mrs. Helen Van Duzee, 1387 spiders, mostly from California; from Dr. E. C. Van Dyke, 1280 specimens, largely from Canada and the east; and from Mr. C. L. Fox, 653 specimens, including a fine series of mounted moths. Other contributors to this department include Prof. H. F. Wickham of the University of Iowa; Mr. J. O. Martin, now of Berkeley; Mr. Louis Slevin of Carmel, California; Mr. J. A. Kusche and Mr. M. F. Blassé of San Francisco; Mr. Ralph Hopping of Berkeley, and Dr. Barton W. Evermann, Mr. J. R. Slevin and Mr. John I. Carlson of the Academy staff. The field work of the curator included a four weeks' trip in Shasta and Siskiyou counties, California, and Jackson County, Oregon, the principal localities being Caton, McCloud and Sisson, California, and Colestin, Oregon, and three-day trips to Los Baños, Sacramento, Mt. St. Helena and Cazadero, California. In all but the Los Baños trip he was assisted by his wife, Mrs. Helen Van Duzee, who, in addition to the spiders already mentioned, took many interesting insects which were added to the collections of the Academy.

In reviewing the work accomplished during the past year on the collections of insects we note that the arrangement of the Coleoptera, or beetles, and the determination of the species, is now nearly completed, thanks to the kind assistance of our local students of this order. Early in the year Prof. F. C. Fall of Pasadena worked up the snout-beetles then in our possession; Mr. Ralph Hopping of Berkeley has revised the family Ipidæ comprising the bark beetles, adding from his own collection many species that were lacking, and Dr. E. C. Van Dyke has revised the Buprestidæ, determining the specimens added during the previous year, and bringing this family, which comprises the flat-headed wood-borers, fully up to date. The bulk of the work on the Coleoptera has, however, been done by Dr. F. E. Blaisdell, to whom the Academy is deeply indebted for his efficient and untiring efforts for more than a year past. He has determined or revised and arranged our material in 53 families of beetles, filling 76 of the large insects trays used by the Academy, completing the work on this order of insects with the exception of three families which are now "in the works." Some idea of the magnitude of the task he has so nearly completed may be gathered from the fact that the Academy collection of named North American beetles now numbers 11,625 specimens, representing 2,187 species.

In the Hymenoptera, which embraces the bees, wasps and ants, Dr. J. C. Bradley completed a preliminary study of the various families of the wasps before his return to Cornell University last spring. The Diptera, or two-

winged flies, are in process of determination, most of the important families now being in the hands of specialists for study. The curator has recently begun the determination and arrangement of the Hemiptera, or true bugs, and thus far has completed 15 families numbering 4,064 specimens representing 400 species. In the Lepidoptera, embracing the butterflies and moths, the work of arranging is progressing as rapidly as the material can be sorted over and determined. These insects, as well as the Neuroptera, represented by the dragon-flies, and the Orthoptera, or grasshoppers and their relatives, are larger and their arrangement must await the purchase of sufficient boxes for their display.

So much time was required in mounting and labeling the material added and in assorting and arranging it and the accumulated material, that little was available for systematic study by the curator. One paper on the new forms of Hemiptera brought to light by the work of the previous year was, however, published by the Academy, in which appeared descriptions of 39 new species or races, mostly from California; and a shorter paper on the Hemiptera taken by the Canadian Arctic Exploring Expedition of 1913-1916 was prepared and sent to the Canadian Government at Ottawa for publication in the scientific results of that Expedition.

During the year the exhibition of exotic butterflies in the mammal hall of the Academy was replaced by a much larger collection of exotic forms numbering 248 specimens displayed in riker mounts, and a start was made on three smaller exhibits; one of California butterflies, another of miscellaneous insects showing mimicry and other interesting features, and one of life history and similar groups, and species of economic importance.

In a science dealing with such vast numbers of forms as does entomology the determination of material must be entrusted to specialists. The curator is qualified to do this work in the order Hemiptera, not only in the Academy collection but for other institutions as well, in return for similar help on other orders of insects. In this way the Museum, through the curator, has furnished information or determination of material for the following 23 students:

Dr. W. H. Brittain, Government Entomologist, Truro, N. S.; Mr. H. G. Barber, Roselle Park, N. J.; Dr. William Barnes, Decatur, Ill.; Prof. Geo. A. Coleman, University of California, Berkeley, Calif.; Dr. J. H. Comstock, Los Angeles, Calif.; Mr. E. L. Dickerson, Nutley, N. J.; Mr. Wm. T. Davis, New Brighton, N. Y.; Mr. R. K. Fletcher, Ohio State University, Columbus, Ohio; Mr. W. M. Giffard, Honolulu, T. H.; Dr. Wm. A. Hilton, Pomona College, Claremont, Calif.; Dr. C. Gordon Hewitt, Dominion Entomologist, Ottawa, Ont.; Prof. O. A. Johannsen, Cornell University, Ithaca, N. Y.; Mr. H. H. Knight, Cornell, University, Ithaca, N. Y.; Mr. Philip Lugenbill, Columbia, S. C.; Mr. J. McDonough, Decatur, Ill.; Prof. Z. P. Metcalfe, N. C. Experiment Station, West Raleigh, N. C.; Mr. W. L. McAtee, U. S. Biological Survey, Washington, D. C.; Mr. W. F. Hamilton, Pomona College, Claremont, Calif.; Dr. H. M. Parshley, Smith College, Northampton, Mass.; Mrs. Annie Trumbull Slosson, New York City; Dr. Carl J. Drake, N. Y. State College of Forestry, Syracuse, N. Y.; Dr. F. H.

Lathrop, Oregon Agricultural College, Corvallis, Oreg., and Prof. S. B. Fracker, State Dept. of Agriculture, Madison, Wis.

In return Academy material has been sent for study to the following specialists: Moths of the family Geometridæ to Mr. W. S. Wright of San Diego, Calif.; spiders to Mr. Nathan Banks, Museum of Comparative Zoology, Cambridge, Mass.; the various families of the Diptera, or two-winged flies, to Mr. C. W. Johnson, Director Boston Society of Natural History; Prof. J. S. Hine, Ohio State University, Columbus, Ohio; Prof. A. L. Lovett, Oregon Agricultural College, Corvallis, Oreg.; Mr. R. F. Cole, Bureau of Entomology Laboratory, Forest Grove, Oreg.; and Mr. M. C. Van Duzee, Buffalo, N. Y. Fortunately the Academy has in its own membership specialists well equipped to care for all families of the great order of Coleoptera, or beetles, whose help has already been acknowledged.

More than 30 entomologists from various states and countries have inspected or made use of the collections of the department during the year.

Another feature of the work of this department merits at least a passing notice. During the past year it has been the custom of the curator and his wife, when not absent on necessary field work, to keep "open house," as it were, at the entomological laboratory for both local and visiting entomologists and their friends, so they can meet, make use of the Academy collections, and generally get better acquainted with one another and talk over the work they may be doing. These informal semi-social afternoons have proved so popular that they will be continued, and all members and friends of the Academy interested in insects will be welcome even if they do not technically classify themselves as entomologists.

One word regarding the needs of this department for the coming year. Our first duty is the accumulation of material representing our local insect fauna and its determination and systematic arrangement. We must begin by building up a reference collection of west American insects. Until this is done educational and display work must be done under conditions not economical of time or money. This preliminary work is now well advanced in the order Coleoptera. If a sufficient number of cases can be secured another year should see the Lepidoptera, Hemiptera and Diptera in a condition of similar completeness, leaving but three orders still unassorted, and possibly these might be gotten into fair shape the following year. Further enlargement of the entomological exhibits will be continued as rapidly as properly determined material can be secured.

Department of Herpetology

By John Van Denburgh, *Curator*

The Department of Herpetology during the year 1918 progressed satisfactorily, notwithstanding many difficulties occasioned by general conditions, the war, and the epidemic of influenza. The entrance into the Navy of the assistant curator, Lieutenant Slevin, prevented any active collecting during the last half of the year, while the demands of the epidemic greatly reduced the amount of time and thought which the curator could devote

to the work of the department. Nevertheless, the work accomplished compares favorably with that of previous years.

At the beginning of the year 1918 the Academy's collection of reptiles and amphibians numbered 35,451 specimens. There have been added during the year 1921 specimens, so that the collection has grown to more than 37,000 specimens.

The number of specimens added during each of the past six years has been about as follows:

1913	2700	specimens
1914	800	"
1915	800	"
1916	1500	"
1917	1600	"
1918	1724	"

Gifts of specimens during the year have been received as follows:

From	Dr. E. C. Van Dyke	163	specimens
"	Mr. R. P. Erwin	258	"
"	Prof. J. O. Snyder	75	"
"	Dr. J. Van Denburgh	19	"
"	Mr. P. H. Peters	26	"
"	Lord Rothschild	1	"
"	Mr. Herbert Pack	2	"
"	Other donors	5	"
		549	

Four collecting trips were undertaken to:

1. San Clemente, San Nicolas, Santa Barbara and Santa Catalina islands.
2. Monterey County, California.
3. Pyramid Lake, Nevada.
4. Northern California and southern Oregon.

These expeditions resulted in the acquisition of 1127 specimens.

Aside from the collection made on the islands, specimens have been secured from 17 counties of California, as follows:

Butte	1	specimen
Contra Costa	3	specimens
Del Norte	45	"
Humboldt	14	"
Lassen	37	"
Marin	6	"
Mendocino	39	"
Merced	2	"
Modoc	41	"
Monterey	67	"

San Benito	7	specimens
San Francisco	1	"
San Mateo	3	"
Santa Barbara	1	"
Santa Clara	6	"
Shasta	32	"
Siskiyou	19	"

Specimens from other localities are:

Idaho	488	specimens
Nevada	12	"
New York	163	"
Oregon	580	"
Utah	2	"
Australia	20	"
China	1	"
Hawaii	87	"
Japan	1	"
Philippine Islands	2	"

The classification and arrangement of the collection was continued during the early part of the year.

Considerable research work has been accomplished during the year and a detailed study of the garter-snakes of the states west of the Rocky Mountains has been published.

It is hoped that during the coming year the work of the department may be carried on without interruptions and that field work may be continued for a longer period.

Department of Invertebrate Paleontology

By Roy E. Dickerson, *Curator*

The principal activities of the Department of Paleontology during the past year have been devoted to finishing some work in the Petaluma, Sonoma, and Tomales Quadrangles, photographing new species from Carrizo Creek, San Diego County, completing the numbering and arranging of the Henry Hemphill Conchological Collection, increasing the Academy collection of types and cotypes through exchange, and the procuring of many collections of recent and fossil shells. Mr. Georges Vorbe and Mr. Merle Israelsky have been valuable assistants during the past year.

The Academy published in the year a paper by Professor E. T. Dumble upon the "Geology of the Northern End of the Tampico Embayment Area." Most of the determinations of fossils listed in this paper were made by Dr. W. S. W. Kew and the curator.

The mapping of the Tertiary formations of the Petaluma Quadrangle and the south half of the Santa Rosa Quadrangle, was completed by the curator during the spring. Incidental to this work, the curator cooperated with the

Sonoma County Farm Advisor in searching for limestone suitable for use in liming the adobe lands in this county. The work upon the Petaluma Quadrangle necessitates a connection with the coastal area around Tomales Bay, so that exploring in this region was started. The Point Reyes Triangle, the land mass on the west side of Tomales Bay, had been previously mapped in a most excellent manner by the former curator of the Department, Mr. F. M. Anderson, so the time available was devoted to a study of the east side of Tomales Bay and the headlands which project into the bay. As is well known, the Tomales Bay region is in the San Andreas Rift Zone. Immediately along the recent rift of 1906 some interesting deposits of Pleistocene age were found in the small headlands on the east side of the bay. Study of these beds resulted in the recognition of two formations of Pleistocene age separated by a well marked unconformity. The beds of the lower formation have been so tilted and faulted that dips as high as 30° were recorded in several places. Both of these formations yielded estuarine faunas mixed with wood and pine cones which Miss Eastwood has kindly identified as the Monterey pine *(Pinus muricata)*. These pine cones occur in both formations and they are particularly interesting in that the pine now found in this region is *Pinus radiata*, and not *Pinus muricata*, which does not range this far north at present. Thus the flora indicates that these Pleistocene deposits were probably laid down during a warm interglacial epoch or epochs. This conclusion is further confirmed when the Molluscous fauna is studied. Most of the species of this fauna are now found in the waters of San Diego and are entirely lacking in the waters of Tomales Bay. These faunas are estuarine and likewise the character of deposits are those of a Pleistocene Tomales Bay. That Tomales Bay existed during the Pleistocene, is very evident when the evidence is studied and it seems entirely probable that the Point Reyes Triangle has been subjected to movements quite different to those of the mainland.

The mollusks of the Carrizo Creek beds are being studied and the new species are being described. An Eocene fauna from Peru which was collected by Mr. Clark Gester was found to contain "that finger post of the Eocene," *Venericardia planicosta*, with other interesting forms which have been previously described, but their formal relations were unknown. Mr. Gester recognized this species in the field and thus obtained a key to some of the Peruvian Tertiary problems.

In June, the curator was granted leave by the Academy and was employed by a California oil company in exploration work. Incidental to this work, he obtained several interesting collections from Oregon and Washington which contain a few new forms. Professor Earl Packard, while in charge of the Geology Department of the Agricultural College of Mississippi, made a collection of some fine material from the type locality of the Chipola marl, a celebrated Miocene horizon of Florida. These collections will be particularly valuable to students who are interested in Pacific-Caribbean problems. He collected such material from the Mississippi Cretaceous as well. Professor Packard, who is now located at the University of Oregon, is arranging to collect for the California Academy of

Sciences in the Cretaceous of Oregon. The material so obtained will serve as a basis for the study of Cretaceous problems of this state. This co-operative arrangement will prove beneficial to the University of Oregon as well, as duplicate material will be donated to that institution by the California Academy of Sciences.

Mr. and Mrs. Oldroyd made collections of recent shells from Friday Harbor, Washington, and from Monterey, California. These collections and a collection of recent shells from Magdalena Bay, Lower California, made by Mr. Orcutte of San Diego, comprise an excellent start of a series of typical locality collections on the Pacific Coast.

Mrs. H. M. Barngrover completed the arrangement of the Henry Hemphill Conchological Collections in a very systematic manner, and installed it neatly and compactly in the cases of the department.

There have been a great number of very useful donations during the past year. A complete list of these is appended to the Director's report. Mr. L. E. Smith gave the department a fine collection of minerals. Mr. H. S. Durden has again enriched the department by further donations of rocks and minerals. Mr. H. W. Bell, Deputy Supervisor, Petroleum and Gas, California State Mining Bureau, recently donated an interesting slab of diatomaceous earth from Lompoc, Calif., in which are embedded some fossil fishes.

Several exchanges have been made during the past year. One of these was an exchange between the Academy and the University of Washington. These cotypes from Washington State are now installed in the Type Collection of the Department, where they will prove useful to Pacific Coast workers.

Types from the California State Mining Bureau have been segregated and may be also consulted. It is the purpose of the Department to make the Type Collection as complete and useful as possible.

Librarian's Report

E. P. Van Duzee, *Assistant Librarian*

During the year just past a very considerable improvement has been made in the condition of the Academy's collection of books. Perhaps most important is the accessioning of the volumes. This work is now well advanced and a few months should see all complete or nearly complete volumes entered. Up to the present about 8,000 volumes have been entered on the accessions register, covering the volumes in the main library room up stairs and those in the departments of Ornithology, Herpetology, Botany and Invertebrate Paleontology. There still remain to be done those in the department of Entomology and in the down-stair stack room. Another improvement that will be much appreciated is the collation and arrangement of the great mass of miscellaneous material in the lower library room, consisting of government, state, and other documents and reports, and the publications of societies not classified as general scientific societies.

In addition to this all single books and many sets of serials not before attended to have been classified, catalogued and the cards filed, so our catalogue is now reasonably complete except for government and miscellaneous institutional reports and publications. Label holders have been attached to the shelves constructed last year for current serials and the 300 and over serials shelved there have been arranged alphabetically and plainly labeled so they are now readily accessible to readers. The work in the library department has been accomplished through the efficient efforts of two assistants who have devoted a portion of their time to this work. Miss Mary E. McLellan takes general charge of the library reading room, enters all serials and exchanges as received on the record cards, keeps them in proper order on the shelves, and makes all entries on the accessions book, while Mrs. Helen Van Duzee has collated, classified and arranged the great mass of miscellaneous documents, reports and serials in the lower library room, including most of the geological surveys and reports and has attended to the classifying and cataloguing done during the year.

The accessions to the library during the past year number 393 complete volumes and a large number of miscellaneous pamphlets, excerpts and odd numbers of serials and society transactions, received by purchase, exchange or as gifts.

As stated last year the most important work before this department is the completion of the work of accessioning the accumulation of material now on hand, for until that is done it will be impossible to make out an intelligent report or to keep track of books currently received. Next in importance is the completion of the card catalogue so it shall cover the departmental libraries and the miscellaneous books in the lower stack room. The addition of about 90 lineal feet of wall shelving at the southwest corner of the lower library room would much facilitate the handling of the books. One suggestion made last year should be again repeated. That is the appropriation of a suitable allowance for the purchase of books for the general and departmental libraries and for the binding of the complete volumes of serials and society publications. A technical library such as this must maintain a constant, even if small, growth.

DEPARTMENT OF INVERTEBRATE ZOOLOGY

By Walter K. Fisher, *Curator*

The work of the department for the year comprised exploration in two widely separated localities, the Lesser Antilles and Puget Sound.

In December, 1917, the curator was invited to accompany an expedition to Antigua and Barbados, British West Indies, organized under the auspices of the Graduate School of the University of Iowa and largely manned by members of the Department of Zoology of that institution. It was decided that the curator would represent the California Academy of Sciences and the Department of Zoology of Stanford University, one-half of the material collected to go to each institution. In addition to this, duplicate

material over and above what should be required by the University of Iowa, the latter institution agreed to furnish available duplicates from the general collections after these had been worked up by specialists.

Professor C. C. Nutting, chief of the expedition (which consisted of nineteen persons) requested the curator to proceed to Barbados in advance of the main party in order to organize suitable quarters. He accordingly did so, sailing from New York April 19, 1918. The main party left about 10 days later.

Extensive shore and shallow reef collections were made in the vicinity of Bridgetown, Barbados, consisting for the most part of the commoner West Indian shallow water forms. The more unusual specimens were of course turned over to the general collections. Dredging up to about 100 fathoms was carried on successfully by Dr. J. B. Henderson, the malacologist of the expedition. The curator accompanied the expedition as expert in Echinoderma, but these animals proving to be not very numerous, his activities covered the entire range of marine invertebrates with the exception of Mollusca, in charge of Dr. Henderson.

After a five weeks' stay at Barbados the expedition moved north to Antigua for a similar period. The base for work was here at English Harbor, an historic fort dating from Nelson's time. The shore collecting proved to be excellent at Antigua, although on account of the prevailing winds dredging was impossible. The number of species encountered at Antigua was not unusually large, but most forms were in abundance.

The expedition arrived at New York August 1, after safely eluding any submarines which might then have been pirating off our eastern coast, and all material reached California in safety.

In the region of Puget Sound Mrs. Ida S. Oldroyd again made a miscellaneous collection of invertebrates at the San Juan Islands, paying more attention to the rarer forms which she did not secure last summer.

Accessions to the Museum and Library

Alexander, Miss Annie, Piedmont: Fifty-five numbers of Proceedings, California Academy of Sciences, and two numbers The Philippine Journal of Science. Gift.

Allen, Charles A., San Geronimo: Thirty-five mammal and 20 bird skins from Nicasio, Marin County, California. Gift.

Anderson, Mr. F. M., Berkeley: Miocene fossils from Coalinga district. Gift.

Antonio, Ferraro, San Francisco: One box of inlaid mahogany. Gift.

Berry, Mr. S. Stillman, Redlands: Five pamphlets. Gift.

Bethel, Mr. Ellsworth, San Jacinto: Seven botanical specimens. Gift.

Blaisdell, Dr. F. E., San Francisco: Three hundred and fifty-five named beetles to fill vacancies in the Academy's collection of insects in certain families. Gift.

Bliss, Mr. Walter D.: Two botanical specimens from Plumas County. Gift.

Brackett, Mr. Harvey G., San Francisco: Section of bone found at Saratoga, California. Gift.

Bradley, Dr. J. C., Cornell University: One large, handsome and rare long-horned beetle *(Crioprosopus magnificus)* from New Mexico. Gift.

Budd, Mr. Charles G., San Francisco: One skull of cow elk. Gift.

Buford, Mrs. S. J., San Francisco: One English ring necked pheasant. Gift.

Burbank, Mr. Luther, Santa Rosa: One botanical specimen. Gift.

Burger, Master Albert, Fort Winfield Scott: One Angora hare. Gift.

California Botanical Club, San Francisco: One hundred botanical specimens. Gift.

Campbell, Mrs. Marian L., San Francisco: Eighteen botanical specimens. Gift.

Carlson, Mr. John I., San Francisco: One hundred and thirty-four botanical specimens, 115 insects from Arizona and southern California, marine shells from San Diego, land snails from Santa Barbara County and minerals from Arizona. Exploration.

Cebrian, Mr. J. C., San Francisco: Botanical specimens from Central America, 3 saws of *Pristis perrotti* from Guatemala, 6 mounted specimens of the Armadillo *(Tatu novemcinctum)*, 1 spiny puffer, 1 Alaska Indian totem, 1 mounted specimen of the Jacana, 1 case of 6 mounted birds from Guatemala. Gift.

Chastain, Mr. J. H., San Francisco: Botanical specimens from Siskiyou County, California; chrome ore and asbestos from Siskiyou County. Gift.

Clemens, Mrs. Joseph, Williamsport, Pa.: Six botanical specimens from Pennsylvania. Gift.

Clokey, Mr. Ira D., Denver, Colorado: Seven hundred and one botanical specimens of Marcus E. Jones collections in California, Nevada and Lower California; also 175 botanical specimens from Colorado. Exchange.

Cockerell, Dr. T. D. A., Boulder, Colo.: Sixteen miscellaneous books and pamphlets. Gift.

Creeley, Dr. E. J., San Francisco: One skeleton adult female Indian elephant. Gift.

Dahl, Miss Adele, Tahoe City, California: One Western Goshawk. Gift.

Davidson, Mr. W. M., Sacramento: One Ceria n. sp. from Imperial County. Gift.

Dean, Mr. Walter E., San Francisco: Thirty-one numbers of the Proceedings of the Academy, Fourth Series. Gift.

Dickerson, Dr. Roy E., San Francisco: One package of fossils from Sonoma County, California; one package of fossil shells from Santa Barbara County, California; one package of Oligocene fossils and 33 specimens of fossils; four packages of fossils from the state of Washington. Exploration.

The Dudley Herbarium: One botanical specimen. Gift.

Durden, Mr. H. S., San Francisco: Two boxes and five packages of minerals. Gift.

Eastwood, Miss Alice, San Francisco: One botanical specimen from Golden Gate Park; one botanical specimen from Botanical Garden, University of California; 5 species of exotic plants with duplicates from Golden Gate Park; 392 botanical specimens from various localities; 3 botanical specimens and two exotics from Mount Davidson, San Francisco; 607 botanical specimens from Colorado, Utah, and California; 71 botanical specimens from Mount St. Helena. Exploration.

Ehrhorn, Mr. Oscar, San Francisco: Five fossil shells and three specimens of mineral ores from Bolivia. Gift.

Erwin, Mr. Richard, Boise, Idaho: One hundred and sixteen frogs; 40 snakes; 257 toads; 43 salamanders and 32 lizards from Idaho. Gift.

Essig, Mr. E. O., Berkeley: Five hundred and eighty-two slides of Japanese plant lice. Gift.

Evermann, Dr. Barton Warren, San Francisoo: Seventy-four botanical specimens from Crater Lake, and from Santa Catalina, San Clemente, and Santa Barbara islands; 8 insects from northern California; 3 Linnets, 1 Willow Goldfinch and 1 Western Savannah Sparrow; 1 snake from Golden Gate Park. Exploration. A miscellaneous collection of shells, corals, minerals, fossils, Indian arrowheads, beads, etc., and various other natural history objects totaling altogether more than 500 specimens chiefly from Alaska, Indiana, Texas, North Carolina, and Porto Rico. Gift. One snake from San Mateo County, one snake from Merced County, and three frogs from San Benito County. Exploration.

Fauntleroy, Miss Sophie, Nordoff: Nine botanical specimens. Gift.

Ferris, Mr. G. F., Stanford University: One entomological specimen mounted on slide of *Hesperoctenes longiceps* Waterh. Gift.

Folger, Mr. A. S., Berkeley, and Dickerson, Dr. R. E.: Fossils from Washington. Exploration.

Fox, Mr. C. L., San Francisco: Six hundred and fifty-three insects, mostly Diptera. Gift.

Frison, Mr. Theodore H., Champaign, Illinois: Forty-three entomological specimens. Exchange.

Gallon, Mr. G., Hollister: One badger. Gift.

Gester, Mr. G. C.: Fossils from Peru. Gift.

Gillon, Mrs. E. E., San Francisco: One tusk of walrus. Gift.

Godfrey, Mr. F. L., Supt., Kahlin Reserve, Australia: Eighty-six specimens of minerals; 3 pearl oyster shells; 5 boomerangs; 3 wristbands; 1 emu skin rug; 3 nets; 1 mat flag; 17 wooden implements; 1 metal bayonet with wooden scabbard; 1 hair ornament; 1 wall-pocket case. Gift.

Golden Gate Park: One California Condor, and one young kangaroo. Gift.

Goldsmith, Mr. Oliver: One botanical specimen. Gift.

Gordon, Mr. W.: Fossils from San Luis Obispo. Gift.

Heath, Dr. Harold, Stanford University: Nineteen botanical specimens from Forrester Island, Alaska. Gift.

Herrin, Miss Alice, San Francisco: One botanical specimen. Gift.

Herrin, Mr. William F., San Francisco: Eighteen botanical specimens. Gift.

Holm, Mr. Adolph, San Francisco: Four botanical specimens. Gift.

Holzinger, Mr. John M., Winona, Minn.: Holzinger's set of Sandberg's collection of Plants of Idaho, consisting of 955 mounted specimens and 200 unmounted specimens. Purchase.

Hopping, Mr. Ralph, Berkeley: Thirty specimens of tropical longhorned Coleoptera. Gift.

Hunt, Mr. H. H., Escalon: One bat. Gift.

Israelsky, Mr. Merle, San Francisco: One arrow-head from Frankfort, Kansas. Gift.

Jones, Mr. J. M., Wilmington, Delaware: Twenty-six entomological specimens from northern California. Gift.

Kusche, Mr. J. August, San Francisco: One hundred and two insects, chiefly from Alaska and Arizona; 87 mammal skins, chiefly from California and Alaska; 337 bird skins, chiefly from California and Alaska. Gift.

Lazansky, Mr. Bernhard, San Francisco: Relic of the great fire of April, 1906; a nickel in slot of telephone box. Gift.

Liebes, Mr. I., San Francisco: Three pieces of fur illustrating method of preparing mink skins for garments. Gift.

Levin, Mrs. A. L., San Francisco: Sixty-six Indian spear and arrowheads. Gift.

Lewis, Mr. W. C., Tiburon: One caribou head from Alaska. Gift.

Lockefeer, Mr. C. J., San Francisco: One lizard from San Mateo County. Gift.

Maag, Mr. Fred, San Francisco: One snake from Marin County, California. Gift.

Markley, Mrs., San Antonio, Texas: Three botanical specimens. Gift.

Martin, Mr. J. O., Berkeley: One hundred and thirty-two insects, including a pair of *Dinapate wrighti* and four examples of *Schizax senax*, both rare California beetles. Gift.

McAllister, Mrs. Leonore M., Ydalpom: Forty-seven botanical specimens. Gift.

McGuire, Mr. Ignatius, San Francisco: One lizard from Santa Barbara County and one snake from Marin County. Gift.

Meiere, Mrs. Ernest, San Francisco: Three botanical specimens (one from Yellowstone). Gift.

Menzies, Mr. Robert, San Rafael: One botanical specimen. Gift.

Merriam, Dr. C. Hart, Washington, D. C.: Twenty botanical specimens. Gift.

Merrill, Mr. E. D., Manila, P. I.: Fifty-five miscellaneous books and pamphlets. Gift.

Merritt, Dr. George W., San Francisco: One specimen Sipunculoidea. Gift.

Miller, Mrs. C. E., Berkeley: One hundred and two botanical specimens from the Santa Cruz Islands. Gift.

Miller, Mr. Irving, Berkeley: Thirteen botanical specimens. Gift.

Neilson, Mr. Fred, San Francisco: One crab, caught in Bristol Bay, Alaska. Gift.

New York Botanical Garden: Sixty-four specimens of plants from Jamaica and 65 specimens of grasses. Exchange.

Nomland, Mr. J. O., Los Angeles: One box of pliocene and miocene fossils from Los Angeles County. Gift.

Noyes, Mr. Russell: Forty-one botanical specimens from Afoguak, Alaska. Gift.

Oldroyd, Mrs. Ida S., Stanford University: One hundred and forty-three botanical specimens from Michigan. Gift; and 406 specimens of shells. Exploration.

Otis, Mr. Ira C., Seattle, Wash.: Sixty-seven botanical specimens from Cascade Mountains. Gift.

Pack, Mr. Herbert J., Salt Lake City, Utah: Two snakes from Utah. Gift.

Packard, Dr. E. L., Eugene, Ore.: One box of fossils from Florida and Mississippi. Exploration.

Page, Mrs. George T., San Francisco: Three walrus ivory bows, 2 pestles, and 1 pipe. Gift.

Palache, Mr. T. H., San Francisco: One photograph of *Pinus lambertiana*. Gift.

Palmer, Mr. Andrew H., San Francisco. Three books. Gift.

Perkins, Dr. Anne E.: Three botanical specimens. Gift.

Peters, Mr. Peter, San Rafael: Forty entomological specimens from Queensland, and 26 herpetological specimens from various localities. Gift.

Ploud, Mr. Wm., San Francisco: One Blue Mountain Parrot from Australia. Gift.

Reed, Mr. C. E., Santa Cruz: Five botanical specimens. Gift.

Reeve, Miss Enid, Pasadena: Six botanical specimens. Gift.

Reynolds, Mrs. L. R., Brockton, Mass.: Three botanical specimens. Gift.

Rixford, Mr. G. P., San Francisco: Three botanical specimens. Gift.

Robinson's Bird Store, San Francisco: One chimpanzee. Gift.

Rothschild, Hon. Walter, Tring, England: One tortoise cast. Gift.

Sandford, Mr. O. N., San Francisco: Thirty-eight botanical specimens from Arizona and southern California. Gift.

Scupham, Mr. John R., Oakland: A small quantity of crude black sand from the delta of the Klamath River, a small quantity of sand from upper ancient beach on Sixis River, Oregon, and a small package of sand from beach at Pandon, Oregon. Gift.

Silviera, Captain J. F., Centerville: One shell from the Caroline Islands and 5 rattlesnake rattles. Gift.

Slevin, Mr L. S., Carmel: Forty-one insects from Paso Robles and Carmel and 130 insects from Monterey County. Gift.

Slevin, Mr. Joseph R., San Francisco: Sixty-five beetles from Crater Lake, Oregon; 227 insects from Channel Islands, mostly from San Clemente; 1 snake from San Mateo County; 3 snakes from Santa Clara County; 9 snakes from Monterey County; 58 lizards from Monterey County; 10 lizards and 2 snakes from Pyramid Lake, Nevada; 1 snake and 2 lizards from vicinity of Mt. Diablo. Exploration.

Smith, Mr. L. E., Sisson: One hundred and ninety-seven books and pamphlets, also various numbers of Academy Proceedings; 14 botanical specimens, 2 boxes of minerals. Gift.

Snyder, Prof. J. O., Stanford University: One salamander from Stanford University; 50 lizards from Honolulu; 15 lizards from Aiea; 7 lizards from Yam Bay, Niihau Island; 2 lizards from Waimea, Kauai Island; 1 snake from Japan and 1 snake from China. Gift.

Stanford University: One botanical specimen. Gift.

Stewart, Miss Colleena, San Francisco: Six botanical specimens. Gift.

Southern Pacific Company: Set of 55 colored slides of the Apache Trail. Gift.

Sullivant Moss Society, New York, N. Y.: Seventy-five specimens of lichens. Purchase.

Sutliffe, Mrs. E. C., San Francisco: Eleven botanical specimens. Gift.

Thompson, Mr. David G.: One botanical specimen, and 6 botanical specimens from Mojave Desert. Gift.

Thompson, Mr. Hugh, San Francisco: One turtle from California. Gift.

Thompson, Mr. J. C.: Snails from Lower California. Gift.

Thompson, Mrs. Lillian Dyer, Swampscott, Mass.: Two slides showing the raduli of *Melongena corona* and *Aplysis protea*. Gift.

Thrasher, Dr. Marion, San Francisco: One old property deed to 80 acres of land in the State of Indiana given in 1823 to John Smeltser of Barbour County, Kentucky, by the President, James Monroe. Gift.

Tucker, Mr. J. F., Tucson, Arizona: Two Indian spear heads, one broken pestle and two pieces of quartz. Gift.

Turner, Mrs. G. M., Riverside: One botanical specimen. Gift.

Turrill, Mr. Charles B., San Francisco: One chinchilla; 1 stone crab from near the Farallones; Journals and Letters, David Douglas. Gift.

United States Custom House, San Francisco: Sixty-three packages of mounted birds, bird skins and bird feathers, seized by Customs Office. Gift.

United States National Herbarium: One box of botanical specimens. Exchange.

Van Denburgh, Dr. John, San Francisco: One snake from Merced County; 1 toad from Hollister; 2 lizards and 1 salamander from San Juan; 15 lizards from Honolulu and 2 salamander skeletons from Los Gatos. Exploration.

Van Denburgh, Dr. John, and Slevin, Mr. Joseph R.: Two hundred and fourteen lizards from San Clemente Island; 2 lizards from San Nicolas Island; 24 lizards from Santa Catalina Island; 58 lizards, 59 snakes, 5 toads, 15 frogs and 49 salamanders from California; 67 lizards, 5 toads, 13 snakes, 14 frogs, 478 salamanders, and 3 turtles from Oregon. Exploration.

Van Duzee, Mr. E. P., San Francisco: Forty-five freshwater shells from Titch ranch, four miles west of Cayton, Shasta County; 413 beetles from Eastern states. Gift. 24 insects collected at Milbrae; 43 insects collected at Ingleside; 667 insects collected at Cazadero; 4247 insects collected in field trip to Ashland, Oregon; 411 insects from Cazadero; 828 insects from Gadwall; 616 insects from Sacramento; 876 insects from Mt. St. Helena, and 1900 insects from various localities. Exploration.

Van Duzee, Mrs. Helen, San Francisco: Nine hundred and forty-three spiders taken in the counties about San Francisco Bay. Gift.

Van Dyke, Dr. E. C., Berkeley: One thousand one hundred and thirty-two insects from Ithaca, New York; 42 insects from Banff, Canada; 88 insects from Port Coulange, Quebec; 149 salamanders, 10 frogs and 4 snakes from Ithaca, New York; snails from Ithaca, New York; sea shells from Alaska. Gift.

Varrelman, Mr. Ferdinand A., San Francisco: Fifty bound volumes, 15 unbound volumes, 533 numbers of Government bulletins, reports, etc., and publications of Societies, 111 miscellaneous pamphlets and excerpts. Gift.

Verrill, Prof, A. E., New Haven, Conn.: Twenty-four insects and 5 larvæ from the outflow of a warm artesian well near Carson, Nevada. Gift.

von Hoffman, Mrs. C., San Francisco: Four pamphlets. Gift.

Waizman, Miss Olga: One botanical specimen. Gift.

Weeks, Mr. Andrew Gray: Two volumes. Gift.

Wetherill, Miss Martha, Chin Lee, Arizona: One botanical specimen. Gift.

Wickham, Prof. H. F., Iowa City, Iowa: Three hundred and sixty-three specimens of Coleoptera. Gift.

Willett, Mr. G., Los Angeles: One hundred and ninety-nine shells from Forrester Island, Alaska. Gift.

Woodrum, Mr. J. H.: Vegetable ivory from Ecuador. Gift.

Wooster, Mr. John, San Francisco: One Indian spearhead from Indian mound in Marin County, California. Gift.

FINANCIAL STATEMENTS

REPORT OF THE TREASURER

for the fiscal year ending March 31, 1919

April 1, 1918, Balance with Crocker National Bank..		$ 1,199.92

Receipts

Dues	$ 1,267.25	
Charles Crocker Scientific Fund Endowment Income	1,194.76	
James Lick Endowment Income	48,083.11	
General Income	15,000.00	
John W. Hendrie Income Account	675.00	
A. K. Macomber Donation	500.00	
W. G. Wright Fund	57.20	
Sundry Advances	9.08	
Insurance	3.87	
Museum	145.96	
Publication	310.72	
Post Card Sales	674.86	
		67,921.81
		$69,121.73

REPORT OF THE TREASURER—*Continued*

Receipts

Brought forward,—total receipts		$69,121.73

Expenditures

Expense	$ 2,378.54	
General Salary Expense	13,050.00	
Bills Payable	14,000.00	
Insurance	579.40	
Interest	15,394.64	
Museum Department Appropriations	6,835.05	
" " " Salaries	9,668.46	
Library	542.33	
Publication	4,441.07	
Museum Construction	422.00	
Office Furniture	263.04	
Tools and Equipment	37.93	
Post Cards Purchased	333.40	
Sundry Creditors	47.68	
Sundry Advances (Museum)	1,790.23	
White Pelican Group	161.44	
Contingent Fund	217.74	
		70,162.95
March 31, 1919, Balance due Crocker National Bank		$ 1,041.22

RUDOLPH J. TAUSSIG, *Treasurer*.

We have examined the foregoing Report of the Treasurer for the fiscal year ended March 31, 1919, with the books and accounts of the California Academy of Sciences, and we have found the same to be correct.

McLAREN, GOODE & CO., *Certified Public Accountants*.

San Francisco, Cal., April 21, 1919.

INCOME AND OPERATING EXPENSES

for the period April 1, 1918, to March 31, 1919

Income

Charles Crocker Scientific Fund Endowment Income		$ 1,194.76	
James Lick Endowment Income		48,083.11	
General Income		15,000.00	
Dues		1,267.25	
			$65,545.12

Expense

Salaries		21,942.25	
Expense, General	$970.33		
Fuel	604.46		
Electricity	218.73		
Telephone	279.45		
Postage	250.56		
Stationery and Printing	238.01		
		2,561.54	
Insurance		575.53	
Interest		15,394.64	
			40,473.96
Surplus for year 1918-19			$25,071.16

BALANCE SHEET

March 31, 1919

Assets

Real Estate:		
Market Street Lot	$600,000.00	
Jessie Street Lot	8,083.65	
Commercial Building	516,818.66	
		$1,124,902.31
Stocks:		
45 Shares Savings Union Bank & Trust Co.		10,000.00
Museum Construction		191,210.92
Museum:		
General Collections	91,119.91	
Tools and Equipment	14,909.48	
		106,029.39
Library:		
Books and Equipment	16,046.42	
Publication	17,880.76	
		33,927.18
Office Furniture		3,009.14
Post Cards in Stock		179.72
Sundry Advances		50.00
		$1,469,308.66

Liabilities

Endowments:		
James Lick Endowment	$804,902.31	
Charles Crocker Scientific Fund Endowment	20,000.00	
John W. Hendrie Endowment	10,000.00	
		$ 834,902.31
John W. Hendrie Endowment Income Account		3,498.98
Alvord Bequest Botanical		5,000.00
A. K. Macomber Donation		3,500.00
William H. Crocker Donation		2,318.73
W. B. Bourn Donation		2,659.31
J. D. Grant Donation		2,610.42
Herbert Fleischhacker Donation		3,500.00
W. G. Wright Fund		240.40
Bills Payable		305,275.00
Sundry Creditors		931.32
Cash:		
Overdraft with Crocker National Bank	1,041.22	
Less Cash in Safe	72.11	
		969.11
Surplus		303,903.08
		$1,469,308.66

W. W. SARGEANT,
Secretary of the Board of Trustees.

AUDITOR'S CERTIFICATE

We have examined the foregoing Balance Sheet, together with the books and accounts of the CALIFORNIA ACADEMY OF SCIENCES, and in our opinion it is properly drawn up so as to exhibit a true and correct view of the Academy's affairs, as shown by the books.

McLAREN, GOODE & CO.,
Certified Public Accountants.

San Francisco, Calif.,
April 21, 1919.

INDEX TO VOLUME VIII, FOURTH SERIES

New names in **heavy-faced** type

Date of issue.	Date of issue.	Date of issue.